SERIES 3, Vol. 24, No. 6

Medical Library

JUNE, 1941

AMERICAN JOURNAL OF OPHTHALMOLOGY

JUN 16 1941

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Subscription price in United States ten dollars yearly. In Canada and foreign countries twelve dollars. Published monthly by the George Banta Publishing Company, 450 Ahnaip Street, Menasha, Wisconsin, for the Ophthalmic Publishing Company. Subscription and Editorial Office: 837 Carew Tower, Cincinnati, Ohio. Entered as second class matter at the post office at Menasha, Wisconsin.

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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 24 JUNE, 1941 NUMBER 6

LENS OPACITIES ASSOCIATED WITH EXPERIMENTAL CALCIUM DEFICIENCY*

PRELIMINARY REPORT

KENNETH C. SWAN, M.D., AND P. W. SALIT, PH.D.
Iowa City, Iowa

The association of cataracts with clinical and experimental hypoparathyroidism (tetany) has been recognized for many years. Recently data have been published which suggest an etiologic relationship between spasmophilia (infantile tetany) and one type of zonular cataract,[1] and between osteomalacia (puerperal tetany) and subcapsular lens opacities.[2] However, evidence has been lacking to show that the hypocalcemia associated with these forms of tetany is the etiologic factor resulting in the lens opacities. Until the recent papers by von Bahr,[3, 4] the experimental production of cataracts by lowering the blood calcium was unsuccessful except in parathyroidectomized animals. Von Bahr was able to induce lens opacities in rats by feeding a rachitogenic diet deficient in calcium and high in phosphates. Also working with rabbit lenses *in vitro*, he found that opacities developed when the lenses were maintained in an artificial "aqueous" deficient in calcium. Control lenses remained clear when the calcium content of the media was that of normal aqueous. However, he did not report opacities in the lenses of living rabbits with dietary hypocalcemia. It is the purpose of this paper to report such opacities.

The calcium content of normal and cataractous lenses was studied by one of us (P. W. S.) in 1933.[5] In recent years, we have studied the relationship between the serum calcium level, the calcium content of the lens, and the development of experimental cataracts. The first experiments with hypocalcemia were made on adult rabbits. No slitlamp nor ophthalmoscopic changes were observed, but microscopic examination of stained sections revealed vacuolization and irregular staining in the newly formed fibers at the equator of a few lenses. As previous investigations had revealed the rate of formation of new lens fibers to be very slow in mature rabbits, a new series of studies on young animals with rapidly growing lenses was initiated in 1939. The weight of the lens of young rabbits was found nearly to quadruple between the ages of 10 and 35 days, and microscopic examination revealed that this growth was associated with the development of a large number of new fibers. Furthermore, it was found that an acute hypocalcemia could be produced in these rapidly growing animals by dietary means alone.

Dietary experiments were made on 18 litters of albino rabbits from three different stocks. Each litter was divided into experimental and control groups and the diets were begun at weaning (15-17 days). The control diets differed from the experimental only by the added content of calcium salts. The initial experiments were made with an artificial diet (0.0003-

* From the Department of Ophthalmology, College of Medicine, State University of Iowa.

percent calcium by analysis) consisting of mineral salts (4 percent), casein (15 percent), sucrose (10 percent), corn starch (40 percent), cellulose (20 percent), lard (3 percent), cod-liver oil (3 percent), yeast (3 percent), and wheat-germ oil (2 percent). However, the young animals did not eat well until ground whole oats (.049-percent calcium by analysis) was added in variable amounts. Care was taken to maintain the same vitamin, mineral, fat, protein, and carbohydrate content and a balanced acid-base ratio. Calcium salts were added to the control diets in quantities up to 5 percent. With these diets it was possible to vary the daily calcium intake of the animals from less than 1 mg. to over 600 mg. per day.

Each of the 49 animals placed on a diet containing less than 0.005-percent calcium developed lens opacities. The first lens changes were manifest 9 to 12 days after dietary treatment was begun and appeared ophthalmoscopically as slits, vacuoles, and black dots near the equator of the lens (fig. 1). These opacities were observed to progress subcapsularly from the equator toward the anterior and posterior suture lines (fig. 2). Tetany became evident in most animals within four to seven days after the appearance of the lens opacities. At this time the muscular spasms usually could be elicited only by exciting the animals, but within 36 to 72 hours attacks became spontaneous and severe with the animals lying in generalized muscular spasm for several minutes. It was possible to relieve these spasms by parenteral administration of calcium gluconate. No opacities or tetany developed in the control group of 44 animals. To avoid loss of the experimental animals by death in tetany when not under observation, all animals were killed 15 to 20 days after the onset of dietary treatment. The calcium content of the sera and lenses was determined by Salit's modification[5] of the method of Kramer and Tisdall. The average serum calcium level after dietary treatment was 4.2 mg. percent in the experimental group as contrasted with 10.8 mg. percent in the control group. There

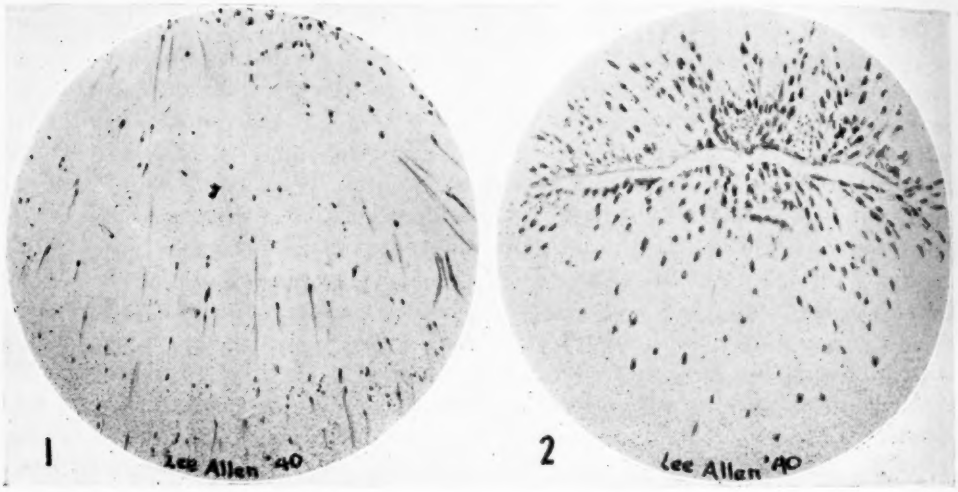

Fig. 1 (Swan and Salit). Ophthalmoscopic appearance of early lens changes. Slits, dots, and vacuoles near the lens equator and extending posteriorly under the capsule.

Fig. 2 (Swan and Salit). Ophthalmoscopic appearance of later lens changes. Opacities have progressed posteriorly under the capsule and are grouped around the posterior suture line.

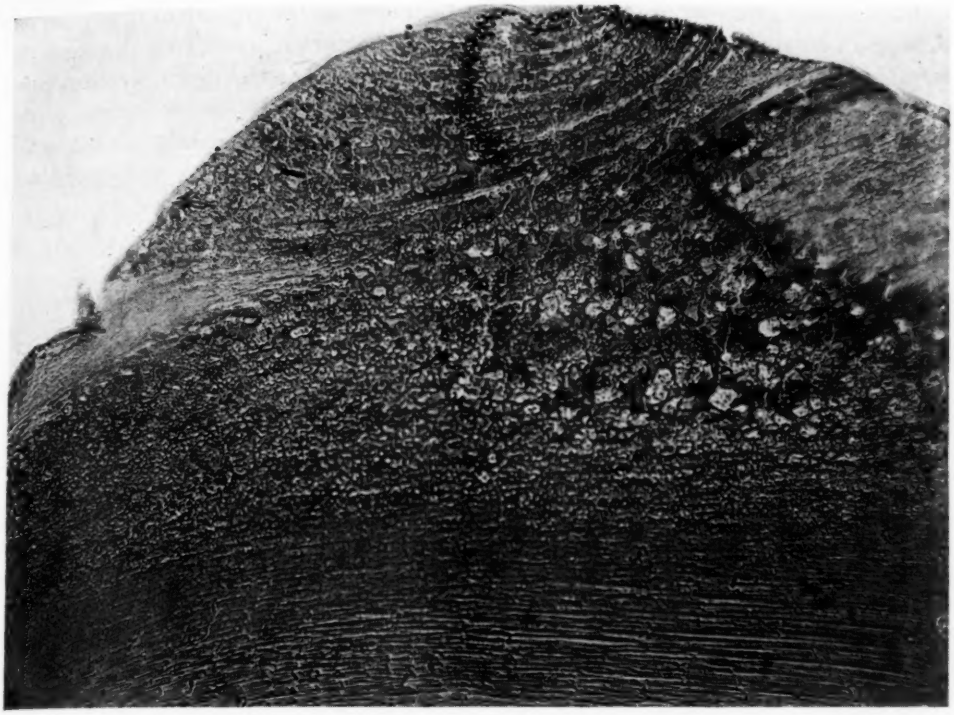

Fig. 3 (Swan and Salit). Section showing vacuolization and disruption of new fibers in equatorial and subcapsular regions of lens.

was no variation between the calcium content of the experimental and control lenses.

A second experimental group of 15 animals received variable amounts of calcium salts in their diets. The serum calcium in this group ranged from 7.8 mg. percent to 8.8 mg. percent. Only four of these animals developed lens opacities and none had evidences of tetany.

TABLE 1

Animal No.	Average Calcium Intake per Day in mg.	Calcium in Serum mg. percent	Gain in Body Weight in grams	Lens Opacities	Water in Lens percent	Tetany
Controls						
S-7	600–700	10.63	114	No	60.7	No
S-8	600–700	10.05	135	No	61.3	No
S-9	600–700	12.25	98	No	60.1	No
Group I						
S-4	30–60	8.00	102	No	59.9	No
S-5	30–60	8.58	116	No	61.6	No
S-6	30–60	8.43	108	No	60.7	No
Group II						
S-1	.08±	3.60	86	Yes	62.6	Severe
S-2	.08±	4.33	80	Yes	64.2	Severe
S-3	.08±	4.30	68	Yes	63.0	Severe

Microscopic examination of the lenses with opacities revealed that the pathology was limited almost exclusively to the newly formed fibers at the lens bow and the subcapsular extensions of these fibers anteriorly and posteriorly. The fibers were irregular in size and staining reaction and contained many vacuoles (fig. 3).

The weights of the pathological lenses did not vary significantly from the controls, although in the former the water content averaged slightly greater (2.8 percent). A larger series will have to be studied before significance can be attributed to the latter finding.

The growth curves and general condition of the control and experimental animals did not vary significantly until after lens opacities became evident in the latter group. Growth of experimental animals definitely lagged after 10 to 12 days on the calcium-deficient diets. Table 1 records the relationship of weight gain, serum calcium level, lens opacities, water content of the lens, and tetany to the daily calcium intake of a litter of nine rabbits on dietary treatment for 15 days after weaning.

Summary

Lens opacities developed in young rabbits placed on a calcium-deficient diet at the time of weaning. These opacities developed in association with low serum calcium and tetany, and could be prevented by the addition of calcium salts to the diet. Only the newly formed lens fibers appeared to be involved. Further studies well be required to determine the mechanism of formation of the opacities and modifying factors.

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PARTIAL COLOBOMA OF THE SCLERAL-LIMBUS ZONE WITH VISIBLE SCHLEMM'S CANAL*

K. W. Ascher, M.D.
Cincinnati, Ohio

Among approximately 20 cases of so-called embryotoxon posterius corneae that have been published during the last decades, only one is characterized by what I consider to be, and propose to call, a partial coloboma of the scleral limbus. It is a case described in 1922 by Kayser,[1] showing a cornea with embryotoxon and with a transparent region of the temporal limbus in an area normally covered by scleral tissue. The whole chamber angle was free to inspection in this region. The absence of any vessel is mentioned.

Normally the outer edge of the sclera extends farther forward and overlaps the border of the cornea, while on the inner side the cornea extends farther back. This is especially manifest in the upper and in the lower part of the periphery of the cornea.

Meckel[2] in 1820, seems to have been the first to describe as a rarity corneal tissue trespassing the scleral limbus. Just 100 years later Kraupa[3] described and illustrated a "defect of the scleral band," occurring in the temporal or nasal limbus. He does not discuss the phenomenon from the histologic nor from the embryologic point of view. Except in Kayser's paper, the relation between this anomaly and embryotoxon posterius corneae has not been mentioned.

According to Duke-Elder, embryotoxon is an annular opacity at the periphery of the cornea, situated in its deeper layers. The opacity appears to be continuous with the sclera, the absence of a clear ring of corneal tissue at the limbus distinguishing this condition from an arcus senilis. But embryotoxon posterius (Axenfeld) is characterized by a narrow concentric band whose transparency is greater than that of the ring itself, lying between the ring and the limbus proper.

The term embryotoxon posterius of the cornea was first used in a description of this condition by Theodor Axenfeld[4] in 1920; but similar anomalies had been observed previously by Mager,[5] by Gloor,[6] and by Sidney Stephenson.[7] It is a congenital anomaly, probably due to an interruption of the resorption of the embryonal corneoscleral membrane (Gluecksmann[8]), formed at the 24-mm. stage and reabsorbed at the stage of 170 mm., when there is no longer an interposition between cornea and sclera.

The anomaly is often connected with defects or network formation of the anterior lamella of the iris with or without pupillary anomalies. Bloch,[9] in a review of 16 cases culled from the literature and one of his own, divided them into three different groups: (1) a complete deep ring at some distance from and parallel to the limbus; (2) a partial band at some distance from the limbus, probably a form fruste of type 1; (3) a broad band of tissue without a free space between it and the limbus.

For many years I have observed cases showing a partial defect of the scleral-limbus zone, and have found that they ordinarily occur in eyes with embryotoxon posterius. Since coming to Cincinnati, I have been able to confirm this finding in the abundant material from Dr. Derrick Vail's office and from the Out-Patient Department of the Cincinnati General Hospital.

* From the Department of Ophthalmology, College of Medicine, University of Cincinnati.

The incidence of embryotoxon is higher than the literature would indicate. Among 167 unselected cases of ocular pathology in Birmingham, Alabama, I found not less than 3 of typical corneal embryotoxa, 2 of which were hereditary in origin—the patient to be described here, and his mother. Two sisters of this man did not show the anomaly. Peters[10] reported a family (two generations) in which a father and two sons had a corneal change very similar, if not identical, with embryotoxon.

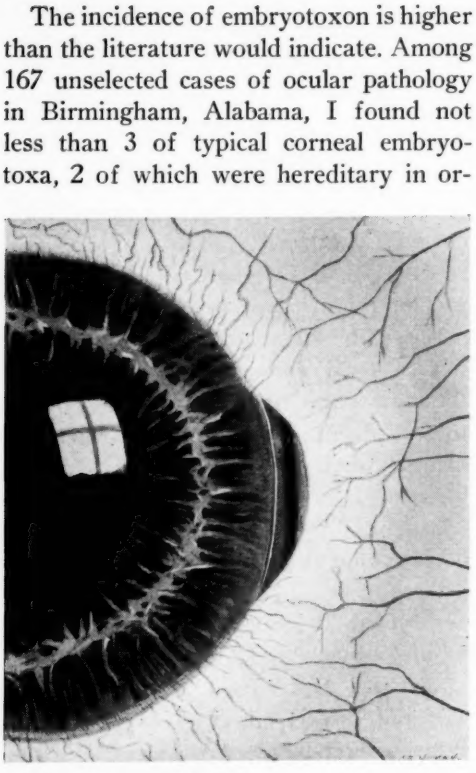

Fig. 1 (Ascher). Coloboma of the scleral limbus. Note that the iris crest is somewhat too bright in contrast with the adjacent tissue. In the area of the coloboma, from left to right, there is first a grayish-white border of Descemet's membrane, then a zone of transparent tissue, a dark vessellike strip, and again transparent tissue encroaching upon the usual border.

In the cases of embryotoxon that I have observed, the defect of the scleral limbus usually corresponded to the site of the embryotoxon. The impression derived is that the anomaly really consists in a partial coloboma of the scleral band which allows a view of the peripheral border of Descemet's membrane or of the normally developed chamber angle. In other words, the cases would suggest that this fine, grayish-white, glassy border could be seen in every eye, were it not covered by the scleral limbus. Histologic confirmation is, of course, needed; all the more since normally at the periphery of the cornea Descemet's membrane thins out and continues as a very thin covering layer on the surface of the angle trabeculae. In histologic examination, as a rule, no sharp edge of Descemet's membrane is visible.

On my last day in Birmingham,* I saw a case confirming this opinion. Unfortunately, the patient could not be seen again that year, but the findings were of sufficient interest to be briefly described.

C. O., a white male, 20 years of age, had had difficulty in reading for the past two months. He complained of headache; had never used glasses; had had an attack of pleurisy eight years previously.

The following description is restricted to the corneal anomaly. The cornea of the left eye between the 2- and 4-o'clock positions showed an embryotoxon posterius, corresponding to what I suppose should be called a partial coloboma of the scleral-limbus zone. With the corneal microscope, direct as well as indirect illumination of the slitlamp showed a dark vertical formation similar to a scleral vessel but very deeply situated in the transparent heterotopic corneal tissue near the border of opaque scleral tissue and parallel to the would-be continuation of the limbus. I was not able to establish a real red color of this formation but there was no doubt about its cylindrical shape and its continuation in the vertical direction up and down.

* This case was observed in the nutrition clinic of the Hillman Hospital, Birmingham, Alabama, Dr. T. D. Spies, director.

Neither vascular ramifications nor tributaries were visible. At the nasal limbus of both corneae, there was a small embroyotoxon, type II (Bloch), between the 2- and 4-o'clock positions in the right eye and between the 8- and 10-o'clock positions in the left eye. There were neither filaments nor other connections between corneal and iris tissue. With the exception of the cornea, the media and the fundi were normal. The intraocular tension was normal in both eyes.

With a small dry syringe, I had intended to withdraw some of the contents of the vessellike feature described in the scleral-limbus coloboma, to ascertain whether it contained blood, and to have the fluid examined to determine the amount of red blood corpuscles.

According to Duke-Elder, whom I quote in giving this brief history of the scleral sinus, Friedrich Schlemm, in 1831, described it as seen in the eye of a criminal who was hanged. In this specimen it was full of blood. Schwalbe in 1870, contended that it was a lymphatic channel, and his view was supported by Heisrath (1880), by Gutmann (1895), and by others, who claimed as a result of injection experiments that a direct communication existed between it and the anterior chamber. Leber (1873-1895), however, demonstrated the artifacts involved in these experiments and proved its venous nature by anatomical demonstration, showing the possibility of its injection through the veins, and the impossibility of its injection by particulate matter from the chambers of the eye: this conclusion has been abundantly verified by subsequent workers (Rochon-Duvigneaud, 1892; Ovio, 1892; Henderson, 1908; Maggiore, 1917; Seidel, 1921; and many others).

In histologic sections of the normal eye Schlemm's canal contains a few corpuscles in about 50 percent of cases. It is to be remembered, however, that many of the anterior ciliary veins are similarly depleted of blood, since, as would be expected when the venous pressure falls at death, the aqueous humor rapidly filters outwards from the chambers of the eye into vascular channels. Fuchs (1900) believed that in life the canal does contain blood, since, under strong oblique illumination, it is visible, as a dark line near the scleral margin of eyes that have a thin sclera; but Troncoso (1925), with the greater facilities of the gonioscope, has demonstrated that in some normal eyes, especially when congested, one or two bright-red, narrow lines appear, bordering Schlemm's zone on either side. They are more conspicuous with the high-power ocular, and are due to a small amount of blood circulating inside of Schlemm's canal; the blood collecting near the walls. Troncoso never has observed the whole Schlemm zone to be of a red color, which would certainly be the case if the canal were a venous sinus as reported by Leber and his school.

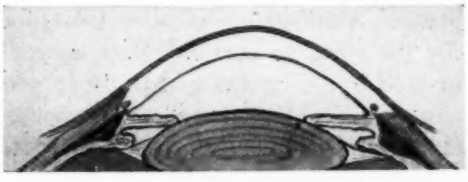

Fig. 2 (Ascher). Schematic drawing of cross section of the anterior segment of an eye showing partial coloboma of the scleral-limbus zone. At the left, the limbus is normal, in a regular oblique line next to Schlemm's canal. On the right, observe the transparent tissue encroaching well below Schlemm's canal.

The peculiar fact that although having a venous connection, Schlemm's canal does not usually contain blood, can be explained by the anatomical observations of Maggiore (1917). The connecting channels running between the canal and

the intrascleral venous plexus are very minute, have an oblique course, are flattened, and have somewhat valvular openings, making retrograde flow difficult. The aqueous can readily enter by diffusion through the thin wall. The hydrostatic venous pressure and the chamber pressure are practically in equilibrium in this region, while an osmotic attraction from the aqueous towards the veins is present. Although it is possible, therefore, for the canal to contain either aqueous or blood, it is probable that, since it is situated in a backwater of the venous outflow, it will have a greater tendency to contain aqueous except when an artificially raised venous pressure opens out the flattened connecting channels and reverses the conditions of the normal equilibrium, according to Duke-Elder.

Recently, Friedenwald[11] has sought and found arterial connections of Schlemm's canal, and, in collaboration with Scholz, has demonstrated that some blood is normally present in the canal. This was accomplished by using liquid air to freeze *in situ* the anterior segment of the eyes of anesthetized experimental animals. The anterior segments were removed in a solid state and allowed to thaw in fixative solutions. Thus fixation was achieved without displacing fluid from the canal. It was found that if the eye had been undisturbed before freezing, blood cells and plasma in low concentrations were present in the canal.

I suspected the described feature in my patient to be a sector of the canal of Schlemm and it would have been of great interest to see whether it contained aqueous humor or blood of normal or diluted concentration. Should there be any connection between the chamber angle and the canal of Schlemm, as is supposed by many authors, one would expect the contents to be aqueous humor or diluted blood. The easiest method of ascertaining whether the blood in this vessel was normal or diluted would be to count the red blood corpuscles after cautious dry aspiration, or to find the protein content of this aspirated blood in comparison to capillary, venous, or arterial blood from the same person. I tried to provoke changes in the described vessel by compression but did not succeed in observing either pulsation or collapse of this feature. Very high compression was not attempted because of the probability of a locus minoris resistentiae at this part of the limbus.

Summary

The occurrence of embryotoxon posterius corneae is not so rare as one would infer from the paucity of present-day literature on the subject.

In a group of 167 cases in Alabama, 3 embryotoxa were found.

Heredity is responsible in the type of case showing a partially visible Schlemm's canal.

A case of bilateral nasal embryotoxon (type II, Bloch), and unilateral partial congenital defect (coloboma) of the scleral-limbus zone is described.

Because of this defect, the transparent corneal tissue extends farther peripherally than usual, and in this region was observed a hitherto undescribed dark vessellike formation, corresponding in size, shape, and location to a part of the canal of Schlemm.

This is the first and only case that has been described in which a part of Schlemm's canal seemed to be visible and accessible from the exterior of the eye.

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FIFTY YEARS' EXPERIENCE IN OCULAR MOTILITY*

Part II

WALTER B. LANCASTER, M.D.
Boston†

DIAGNOSIS OF DEFECTS OF OCULAR MOTILITY

This includes: (1) diagnosis of the amount and direction of the deviation; (2) diagnosis of the implications of the history; (3) diagnosis of the amplitudes of fusion; (4) diagnosis of the state of the correspondences; (5) diagnosis of the causes.

Among those whom we regard as most competent to judge, there is agreement that the cover test is the most reliable method of diagnosis of the direction and, with the aid of prisms, of the amount of the deviation in both heterophoria and heterotropia. But taking the profession as a whole, the Maddox-rod test is the most popular because it is so easy for both patient and doctor and, on the whole, seldom misleading. As a quick procedure in the routine of more or less hurried office practice, the Maddox-rod test is satisfactory. One can tell whether it needs to be checked by the cover test in some form, partly by the magnitude of deviation shown for distance and for near, partly by the amplitude tests, which give a most valuable check, and partly by the symptoms, which, after all, are the most important consideration.

In using prisms to measure a deviation—for example, an esophoria—either by the Maddox-rod or by the cover test, also in using prisms to measure amplitudes of prism vergence, one can save time by taking advantage of the fact that rotating a prism changes its power in the meridian being tested. For example, with the Maddox-rod giving a vertical line seen by the left eye to the left of the light, a prism of 8$^{\Delta}$ is picked up and held before the right eye, base out. Suppose this moves the line from the left side of the light to the right side, in other words overcorrects. Before changing to another prism, rotate the 8$^{\Delta}$ prism so that the base is a little up or down not exactly out. This reduces the effect in the horizontal and introduces a component that in this

* Read before the Pacific Coast Oto-Ophthalmological Society in June, 1940. Part I appeared in the May issue.

† Now of the Dartmouth Eye Institute, Hanover, New Hampshire.

case has no effect because the line is vertical. The amount of tilting gives a quick clue as to what prism to choose next. If it has to be rotated over half way to the vertical, time should not be wasted by trying next a 7Δ, then a 6Δ, then a 5Δ, but the jump should be made at once to a 4Δ. If this prism is too weak, it should be rotated around a vertical axis so that the eye looks obliquely through it and its power is increased. If a slight rotation suffices, the correct power is between 4Δ and 5Δ.

I believe that the cover test should be more widely used. It is certainly significant that the recognized leaders use it so much. I am sure that it would be used more if examiners were more familiar with the method. Probably the commonest fault of procedure is not having enough good light* on the patient's face. By good, I mean that it should not be glaring, for then the patient cannot easily open his eyes widely enough for the examiner to see. But unless the light is strong enough, how can the very slight movements be seen by which the examiner determines whether the prism has corrected the deviation? I have found that it is a great help in examining the several directions of gaze to have small lights of different colors in various parts of the room, under the control of conveniently placed switches. If only one or two lights are available, the patient's head may be so turned that he has to look in whatever direction is desired. Doubtless it would be a further refinement to have some of the lights winking and so better calculated to hold the attention of the patient.† A squeaking device easily manipulated by the hand that also holds the light is simple but useful.

The combination of light and sound is more effective with infants. Chavasse suggests that the mother hold the infant and the father the fixation light before his own face while keeping up a constant flow of talk; the examiner, who has been gently moving the child's doll (or other toy) in the vicinity of the eye to be covered, should move the doll this time over the line of sight.

If the patient is a sufficiently good observer (young ones are often better than old) the parallax test is a still better form of the cover test, easier to apply and much more delicate or sensitive for small amounts; for example, 1Δ.

A recent development of the cover test is the Lancaster red-green test: in a darkened room, the patient with red-green spectacles (red over the right eye, green over the left) looks at a white screen on which the examiner projects a red spot of light. The patient sees the red spot with his right eye and fixates it on command. With his left eye he sees nothing, for the red spot is not visible through the green filter and screen, and its markings are not visible to either eye through the red-green spectacles in the darkened room. If the room is light enough so that with both eyes the patient can see the edge of the screen, for example, or any other object, he will fuse the images and there will be no deviation—the test is useless. Thus we have the conditions of the cover test—one eye fixating a given point and the other eye screened or covered so that it cannot see. Under the innervation set up by the right eye fixating the red spot, the left eye takes a certain position—the fusion-free position. The problem is to measure exactly the position of the left eye, its deviation. With the cover test as ordinarily used, the examiner determines this by removing the cover and watching sharply what that eye does. If it moves to fixate the object, then it was deviating under the cover. By the skillful selection

* This is the opinion of Dr. James White (personal communication).

† Chavasse, p. 428.

of prisms, one is found by trial that makes the left eye execute no movement of redress because through the prism it sees the object just where the right eye does. Thus the prism measures the amount and direction of the deviation. For the red-green test the white screen (which may be the white or light-colored wall, or, if the patient is in bed, the light-colored ceiling) may be marked off in squares that subtend 2 arc degrees or 4 prism diopters at a distance of two meters (half that at 4 meters, twice that at 1 meter). The visual axis of the left eye, covered with the green glass, cuts the plane of the screen at some point. If a green spot could be put at that point, the patient would see it with his left eye. Its image would fall on the fovea of the left eye just as the image of the red spot which the right eye is fixating falls on the fovea of the right eye. By the law of corresponding points, the two images would appear to the patient to be in exactly the same direction, one superimposed on the other. Thus all that is needed is to give the patient a green projector and tell him to move the green spot, which he throws on the screen, so that it lies directly on the red spot. He places it at the point on the screen which the left eye was fixating. The examiner notes the direction and distance of the green spot from the red spot. This measures the deviation. With a pencil red at one end, green or blue at the other, the deviation may be recorded on a card marked in squares like the screen.

To determine the deviations in all cardinal directions of gaze is the work of a moment. Since the spots are dashes, long and narrow, it is easy to show tilting of the eyeball—torsion, declination.

One of the greatest advantages of the Lancaster red-green test is that the positions on the chart are direct readings, whereas ordinary diplopia tests (red glass over one eye) show everything inverted or reversed. Thus if the green spot on the chart is to the right of the red, the left eye has been shown to deviate to the right. If it is above, the left eye is above the right eye. If it tilts with its upper end to the right, the left eye tilts to the right (conclination or intorsion). On the other hand, with the diplopia test, if the image in the left eye is seen to the right, the left eye has been shown to deviate to the left; if it is seen above, the eye is deviating down.

The differences between the red-green test and the ordinary diplopia test with a red glass are:

LANCASTER RED-GREEN TEST	ORDINARY DIPLOPIA TEST
Two lights are seen as one	One light is seen as two
Both images fall on the fovea	One image is not on the fovea
Both images are therefore of maximum vividness	One image is on the periphery; is less vivid
Patient does not have to describe anything	Patient has to describe position of images and estimate how far apart.
Can be used either in heterophoria or heterotropia	Can be used only in heterotropia

Since the patient has to place the green spot so that its image falls on the fovea, his behavior is very characteristic if he has suppression at the macula or central scotoma from any cause. In such cases (and some others also) it is better that the examiner hold both projectors. He shows the red spot on zero on the screen if he is testing the left eye and moves the other light in from the periphery. The patient, while fixating the red spot (of course with his right eye), is asked to tell on which side of the red spot he sees the green spot (of course with his left eye). He can tell as long as it is on the periphery. As it is moved nearer he can tell that it is getting nearer. Rather suddenly he cannot tell where it is, it has entered the suppression area—the scotoma—but as the light

is moved farther, perhaps to the other side, he soon sees it again. In testing the right eye, the green spot is thrown on zero for the left eye to fixate and the red spot is moved about.

By careful manipulation, it is possible to demonstrate in some cases not only anomalous correspondence but a response from the true fovea. In these cases, the patient sees the green light on the red in two different places, one on the pseudomacula and the other fainter, because suppressed, on the true macula. Cases of anomalous correspondence with this behavior are rare. Anomalous correspondence is much easier to demonstrate with the major amblyoscope (synoptophore, for example).

The red-green test is particularly good for demonstrating presence or absence of concomitance, since testing in the various cardinal positions is so easy and speedy.

If I were to appraise the Lancaster red-green test on the basis of several years' use of it, I should say it is of greatest value in paralysis or paresis, next in squint, and less in heterophoria. It requires very much less time than do other methods of testing paralytic conditions, and findings are far more easily and accurately recorded. As a means of demonstrating to the onlooker (parent or friend) the presence of a deviation and the effect upon the deviation of glasses or other treatment, it is impressive and has no rival. It does not take the place of a working knowledge of the physiology, normal and pathological, of ocular motility, but it is a very useful tool in analyzing disturbances of ocular motility. It is a simple matter to secure fixation with either eye: exchange projectors with the patient and you throw the green spot on the screen for him to fixate, while he handles the red spot. It is very easy to show the difference between primary and secondary deviation according to whether the well eye or the paralyzed eye does the fixating.

The Lancaster red-green test differs from the cover test in that, while one eye fixates in both, instead of finding the position of the nonfixating excluded eye by removing the cover and watching intently for a movement which shows whether a deviation, large enough to be discerned in that way, was present, the red-green test determines the position of the nonfixating excluded eye by having the patient project a green spot so that it falls on the red spot which is being fixated. Thus while manipulating the green light, that eye is not "blind," not excluded from seeing. How much this difference affects the measurement, time will tell. One can make use of a cover over the green glass to exclude that eye entirely and then quickly remove the cover and ask about the position of the green spot held by the surgeon at the place on the screen previously selected by the patient just as the cover is used with the Maddox-rod in the excellent rod-cover test which was worked out by Dr. Dolman of San Francisco, while he was on my staff at the Aviation Research Laboratory during the World War.

Amplitudes

Another effective way of diagnosing deviations is with a major amblyoscope, a reflecting stereoscope. The results with such an instrument are influenced by the fact that looking into a machine affects the reflexes, and so the results sometimes, but not often, are different from those obtained by the cover test.

The second factor in the diagnosis of motor anomalies is the important feature of amplitudes. Amplitude of accommodation is important in dealing with errors of refraction and accommodation. Amplitude of fusion is even more important in dealing with motility. One can make a shrewd estimate of the amplitude of ac-

commodation if he knows the patient's age. There is no such easy clue to amplitudes of convergence, divergence, or vertical divergence, positive and negative. They must be ascertained by measurement. The amplitude of convergence requires two measurements: (a) the near point of convergence. In this the accommodation is active as well as its closely associated function of convergence. (b) The amplitude of convergence (relative convergence) when accommodation is not encouraged but if possible prevented by having the fixated objects at a distance of 6 m. This is better than fixating near objects through plus lenses which make accommodation unnecessary but do not eliminate the near reflex; in either case care must be taken that the eyes remain focused for distance. If the patient is allowed (much more, if he is encouraged) to exercise his accommodation he can converge much more.

To measure convergence while fixating at 20 feet, prisms bases out, are used to compel convergence. The strength of the prisms is increased, preferably with a rotary prism, until the break to diplopia occurs. Then the strength is reduced until the diplopia is overcome. Both break and recovery points may be recorded.

Another way is to use an amblyoscope or other haploscope and make the eyes converge by causing the axes of the tubes to converge, and reading the break and recovery points on the scales.

One reads and hears constantly the idea that in measuring, for example, the amplitude of divergence, whether by prisms or by amblyoscope, one is measuring the strength of the lateral rectus muscles. In the average patient the prism divergence will be about 6^{Δ} to 7^{Δ}; this is equal to 3 to 4 arc degrees. Now the lateral rectus can readily rotate the eye 45 degrees (the other being occluded and therefore moving conjugately). Moreover. to rotate the eyes through 4 degrees of divergence takes very little muscular power—a pull of 2 grams would suffice (the antagonists being relaxed by reciprocal innervation). But these muscles are capable, judging from their cross section, of exerting a pull of 700 grams or more. One can speak only figuratively of the prism divergence as showing the *strength* of the lateral recti. It shows the ability to diverge (the strength of divergence) and the prism convergence shows the ability to converge. If the accommodation is adjusted for distance during the test, it shows the power of relative convergence. But this does not depend on the *strength* of the muscles. It depends on the innervation, the coördination, the ability of the patient to call into action the requisite reflex neuromuscular activity.

Always keep clearly in mind that we are dealing with a weak or insufficient *function,* not with a weak or insufficient *muscle.*

Speaking of operations on the ocular muscles Landolt* has said: "There are two indispensable requisites: understand the nature of the disease we attack. Understand the way the operations work."

The reason for insisting so strongly on the importance of the vergence reflexes or functions (convergence, divergence, and so on) is that it is by these reflexes that heterophoria is overcome, compensated, and binocular vision achieved.

History

Emphasis should be placed on the history of the case. Has the patient been able to use his eyes freely with comfort? If he has, it is evident that any existing heterophoria is unimportant clinically. His vergence reflexes are so efficient that they compensate without symptoms of over-

* Graefe-Saemisch Handbuch, Section x, p. 134.

work or strain. Thus it is not sufficient merely to measure the amplitudes. The history must be studied to see how they perform. Some patients by a mighty effort or by a large capacity for temporary exertion can make a good showing; for example, of convergence power. The history shows that they cannot keep it up. Thus the vergence reflexes must either be strengthened by orthoptics, or the amount of work required of them reduced by operation, or the general endurance improved by general treatment, or all methods must be combined. The ophthalmologist whose viewpoint is so narrow that for him the whole trouble is a *weakness of the internal recti,* or, even still narrower, of the right internal rectus, has much to learn before meeting Landolt's requirements of understanding the disease he attacks and how the operations work.

(Part III will appear in the next issue.)

THE STERILIZATION OF SHARP INSTRUMENTS BY CHEMICAL SOLUTIONS*

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In the sterilization of sharp instruments, two requisites are of paramount importance: 1. Proper sterilization. 2. The preservation of the instruments in their fullest efficiency.

Among the methods available for the accomplishment of these ends may be mentioned boiling the instruments in water under atmospheric pressure, heating them in dry air or in oil, exposing them to formaldehyde gas, and, lastly, immersing them in various chemical solutions.

It has long been known that steel blades can be boiled, especially in alkaline solutions, without damage, provided that no electrolytic action occurs. This requirement can be met only by using instruments that will not generate such reactions and by sterilizers that are in perfect order, for only under these circumstances can the solutions be kept free from oxygen, carbonic or other volatile acid, or metallic salt while boiling.

In order to test this method under ideal conditions, a number of cataract knives with various types of handles in common use were boiled in "Pyrex" or similar glass dishes. In the first experiment three knives with aluminum handles were boiled for 15 minutes or longer—one in ordinary tap water, one in distilled water, and one in 1-percent sodium hydroxide. No blade was injured in the least, but all three handles were heavily oxidized. That this oxidation was not due to a reaction from "Pyrex," but rather from the aluminum handles of the knives, is shown by the fact that the boiling of ordinary tap water in an aluminum pan for a short time will result in oxidation of all portions of the pan in contact with the boiling water, whereas water boiled in "Pyrex" dishes yields no reaction of this nature. In efforts to repeat these experiments, several knives were boiled in sterile water in glass containers of various makes, one of them of "Pyrex." After a few minutes the blades were all heavily oxidized, while the handles, made of nickel-plated brass and other alloys, were unaffected. Evidently, an electrolytic action was set up between the carbon steel

* Read before the American Ophthalmological Society, Hot Springs, Virginia, June, 1940.

of the knife blades and the alloys composing the handles, which resulted in oxidation of the carbon steel. From these observations it is obvious that it is impossible to obtain satisfactory conditions for the boiling of sharp instruments in various aqueous solutions, and that one must look elsewhere for the best procedure to achieve the desired results.

Concerning other possible methods, we also find various drawbacks. Heating in dry air requires special apparatus and at least one-half hour exposure to the desired temperature; that is, 150°C. to 160°C. Heating in oil is quite satisfactory in many respects, but oil is unpleasant to handle and difficult to remove from the instruments after sterilization is completed; moreover, the temperature must be watched to prevent the development of excessive heat. Exposure to formaldehyde gas is effective, but requires special, somewhat complicated apparatus, and the gas in also deleterious to aluminum. The use of various chemical solutions, therefore, appears to be the most desirable method, provided suitable solutions that will effect proper sterilization without damaging the instruments can be found.

When this problem first presented itself to me, it was customary to immerse the instruments in 95-percent carbolic acid for about three minutes, and then in 95-percent alcohol for an indefinite period, finally plunging them into a water-bath. Many knives were ruined, and practically all of them required sharpening after each operation. I found that my senior associate, Dr. A. E. Ewing, who had previously been boiling his knives in albolene, was experimenting with various solutions, from which he evolved the following formula, which he believed would satisfactorily answer all requirements:

Liquor cresolis comp.	2.4
Liquor petrolatum	16.0
Commercial chloroform	120.0
95% ethyl alcohol ..... q. s. ad	240.0

He demonstrated that knives and scissors were not injured by this solution even after they were immersed in it for many days. It, therefore, remained only to prove that the solution was sufficiently germicidal for our purposes. Dr. Ewing suggested that I undertake a series of studies concerning its sterilizing properties.

The results of my investigation were reported in the American Journal of Ophthalmology in January, 1928. I quote from that article, after making slight changes in the wording in the interest of clarity:

"Through the courtesy of Dr. D. L. Harris I was provided with broth cultures containing a mixture of staphylococcus albus and aureus, streptococcus, Klebs-Löffler and typhoid bacilli. Two-inch black threads, no. 40, were immersed in this mixed culture and allowed to remain for at least 10 minutes. They were then thoroughly dried, after which they were placed in the sterilizing solution for periods varying from one fourth of a minute up to 10 minutes. Upon removal they were dropped into sterile broth and incubated for 48 hours. Repeated experiments showed that growth appeared in all tubes containing threads which had been in the germicide for periods of less than one minute, but in no instance where exposure had lasted for one minute or more could any contamination be found."

The quotation continues with the statement that: "It is not believed that this solution is sufficiently potent to kill spores, except after a period of several days, but from a practical point of view it does not seem necessary that it should do so. Further experiments along this line should prove of interest."

Since then a solution similar to the one recommended in the paper quoted has been used routinely in the eye clinics and for practically all eye surgery in the hospitals associated with the Washington University Medical School, at St. Luke's

Hospital in Saint Louis, in our office, and possibly elsewhere. As I watched its use, and sometimes misuse, doubt has arisen in my mind as to its efficiency under various conditions. For this reason it seemed advisable to repeat the earier experiments. I took up the problem with Dr. Louis A. Julianelle, of the Oscar Johnson Institute, who has given many most valuable suggestions and has placed the facilities of his laboratories at my disposal. Through his kindness I have also had the invaluable services of Mr. William Moore, without whose painstaking efforts and knowledge of technique these studies would have been impossible.

There are a number of proprietary solutions for the sterilization of instruments on the market. Prominent among these are the two Bard-Parker solutions, with formaldehyde and various alcohols as their most active ingredients. From a few observations it would appear that their claims for efficiency are substantiated. The manufacturers, however, do not recommend them for the sterilization of aluminum-handled instruments. Metaphen and merthiolate are two well-known preparations that, in aqueous solutions at a concentration of 1:2,500 and 1:1,000, respectively, may be used for the same purpose, the manufacturers asserting that sterilization will be accomplished in about five minutes; they do not, however, recommend sterilization for periods longer than 30 minutes, as both preparations are dependent upon mercury compounds for their bacterial activity. Eli Lilly and Company give warning that, due to its mercurial content, merthiolate has a "tendency to discolor rubber, attack aluminum, glass, and varnish, and in aqueous solutions cause rust in steel instruments." It is interesting to note that the Abbott Laboratories, manufacturers of metaphen, point out that instruments should be washed free of blood before they are immersed in the sterilizing solutions, as the germicidal power of such solutions is impaired by blood.

While the effectiveness of these preparations is unquestioned, it is obvious that it is desirable to have a germicide of high potency—not of a proprietary nature—that can be compounded in a few minutes by any pharmacist. Moreover, in most of these proprietary solutions, as pointed out by the manufacturers, there are certain disadvantages that might be overcome by using different components.

These considerations, in addition to those previously mentioned, have stressed the importance of reviewing our previous work, and have made it possible to present a new solution, superior in a number of ways to the one reported 12 years ago, which depended for its germicidal properties upon its cresol and alcohol content. To these ingredients was added liquid albolene, for preservation of the knife blades, a constituent that required the addition of chloroform in order to keep it in solution with the other components.

The original preparation, containing 1 percent of liquor cresolis compound, will be shown in our protocols as solution no. 1. A second combination, containing 2 percent of liquor cresolis compound, similar in all other respects to solution no. 1, will be reported as solution no. 2. In both of these solutions the tendency of the albolene to separate out in the form of an emulsion upon evaporation of the highly volatile chloroform constitutes a serious drawback. For this reason, various other combinations have been tried, eliminating both the albolene and the chloroform, but adding other germicidal substances, with the object of developing a more stable and more highly bactericidal product, and one that would, at the same time, exert no deleterious effect on sharp instruments. The following formula, it is

believed, will fulfill these requirements:

Cresol (U.S.P.)	2.0
Formaldehyde (U.S.P.)	2.0
Thymol (U.S.P.)	2.0
95% ethyl alcohol	94.0

All four components have highly germicidal properties. Cresol and formaldehyde are used solely for this purpose. Thymol is added for its two-fold action: first, for its sterilizing properties and, second, to disguise the somewhat unpleasant odor of cresol and formaldehyde.

For office use, 1-percent oil of lavender has been found an agreeable addition, but it should be noted that in the experiments here reported this ingredient was not added. Concerning the use of alcohol of 95-percent concentration: While it is recognized that 70-percent alcohol possesses a somewhat higher germicidal power, it must be remembered that 70-percent alcohol also carries a higher water content, with its potentialities for the production of rust. That in this instance this latter property is more deleterious than the former is desirable will be demonstrated by our experiments on the germicidal properties of the solution recommended. This new germicide is referred to in the following protocols, and is reported as solution no. 3.

Our findings will be recorded from the two points of view suggested in the opening paragraph of this paper: first, sterilizing properties and, second, effect upon the instruments.

Considering the subject from the standpoint of sterilizing properties, the following experiments are reported:

Experiment no. 1. Squares of gauze, approximately 5 by 5 mm., were first sterilized by dry heat, then immersed in a mixed broth culture containing Staphylococcus aureus, pneumococcus, and streptococcus. From this mixed culture, the squares were transferred to the sterilizing solutions described previously; for 0.5 minute, 1 minute, 1½ minutes, 2 minutes, 5 minutes, and 10 minutes. After the indicated time had elapsed the gauze squares were removed, allowed to drain for five seconds, and dropped into a tube of sterile broth. These tubes of broth, with the gauze squares in them, were incubated and were read after 24 hours, 48 hours, and 6 or 7 days. In all doubtful instances microscopic examinations were made. Controls were also made to determine whether sufficient germicide could be transferred by the carrier to arrest bacterial growth in broth cultures. This was done by inoculating tubes of sterile broth by placing in them gauze squares that had previously been immersed in the mixed culture, after which other gauze squares just withdrawn from the sterilizing solution were dropped into the inoculated tubes.

This experiment proved that in all three solutions immersion for one-half minute was sufficient to prevent all bacterial growth. None of the controls, on the other hand, remained sterile.

EXPERIMENT NO. 1

CARRIER: Gauze squares

CULTURE: Mixed Staphylococcus aureus, pneumococcus, streptococcus

Sterilizing Solution	Duration of Exposure to Sterilizing Solution						Control	Incubation Period
	½ min.	1 min.	1½ min.	2 min.	5 min.	10 min.		
No. 1	−	−	−	−	−	−	+	24 hours
	−	−	−	−	−	−	+	48 hours
	−	−	−	−	−	−	+	3 days
No. 2	−	−	−	−	−	−	+	24 hours
	−	−	−	−	−	−	+	48 hours
	−	−	−	−	−	−	+	3 days
No. 3	−	−	−	−	−	−	+	24 hours
	−	−	−	−	−	−	+	48 hours
	−	−	−	−	−	−	+	7 days

Experiment no. 2. It was deemed advisable to perform experiments of a similar nature, with the use of an ordinary pair of scissors instead of the gauze squares, so as to simulate actual working conditions, and in order to determine the ability of the solutions to sterilize the tight joints of such instruments. A mixed culture, similar to that used in the first experiment, was poured into a pan to a sufficient depth completely to immerse the scissors, which were then partly opened and vigorously agitated in the solution for 15 to 30 seconds. After removal, they were allowed to drain for 5 seconds, and were then dropped into the sterilizing solutions for periods of 0.5, 1, 3, and 5 minutes, and again allowed to drain for five seconds. Finally, the scissors were placed in a flask of sterile broth, which was shaken thoroughly in order to secure perfect contact. The readings made after 24 hours, 48 hours, and 4 days are indicated in the protocol. As a control, a flask of broth was inoculated with 0.1 c.c. of the culture, after which scissors that had first been immersed in the sterilizing solution were washed off in the inoculated flask in order to determine whether a sufficient amount of the germicide could thus be carried over into the inoculated broth flask to destroy the organisms that had been introduced into it.

The protocols of this experiment show that solution no. 1 required five minutes for complete sterilization, whereas solutions nos. 2 and 3 each required only one minute. Again, all controls were positive.

Experiment no. 3. Considering the possibilities for contamination of the solutions and the consequent reduction of their germicidal properties, it seemed that the most likely source of such contamination was from the introduction of protein by bloody instruments thrown into the solutions for sterilization. In order to investigate the extent of such attenuation, experiment no. 3 was carried out. For this purpose, 1 percent of rabbit serum was introduced into solutions nos. 1 and 2, and 1 percent of human serum into solution no. 3. It will be seen, from the protocols of these experiments, that the sterilizing time was somewhat increased by this procedure. In the interest of greater accuracy two series of experiments were carried through. With the first two solutions at least five minutes' exposure was necessary to insure that all bacterial activity had been destroyed, but 10 minutes' exposure was deemed preferable. With solution no. 3 complete sterilization resulted in all instances after immersion for one minute. Again, all controls were positive.

EXPERIMENT No. 2

CARRIER: Scissors

CULTURE: Mixed Staphylococcus aureus, pneumococcus, streptococcus

Sterilizing Solution	Duration of Exposure to Sterilizing Solution				Control	Incubation Period
	½ min.	1 min.	3 min.	5 min.		
No. 1	+	+	±	−	+	24 hours
	+	+	+	−	+	48 hours
	+	+	+	−	+	4 days
No. 2	+	−	−	−	+	24 hours
	+	−	−	−	+	48 hours
	+	−	−	−	+	4 days
No. 3	−	−	−	−	+	24 hours
	−	−	−	−	+	48 hours
	+	−	−	−	+	7 days

Experiment no. 4 was carried out in order to determine what effect the introduction of 5 percent of whole blood into the mixed bacterial culture would have upon the time necessary for sterilizing the instruments infected by the culture so treated. We found that the period of immersion required for sterilization was increased even more. The protocols shows that in some instances positive growths were found even after 10 minutes' exposure to the action of solutions nos. 1 and 2, whereas no positive results were obtained after three minutes' immersion of the carrier in solution no. 3, even when read after seven days' incubation. All controls were positive.

In the preliminary studies, 2-inch sections of nonsterilized cotton string were used as carriers. This resulted in a heavy contamination of the broth tubes by the hay bacillus, presenting an opportunity for studying the effect of these various solutions upon this spore-bearing organism.

EXPERIMENT NO. 3A

CARRIER: Scissors

CULTURE: Mixed Staphylococcus aureus, pneumococcus, streptococcus

Sterilizing Solution	Duration of Exposure to Sterilizing Solution				Control	Incubation Period
	½ min.	1 min.	3 min.	5 min.		
No. 1: 1-percent rabbit serum	+	+	−	−	+	24 hours
	+	+	±	−	+	48 hours
	+	+	+	−	+	3½ days
No. 2: 1-percent rabbit serum	+	±	±	±	+	24 hours
	+	+	−	−	+	48 hours
	+	+	−	−	+	3 days
No. 3: 1-percent human serum	−	−	−	−	+	24 hours
	+	−	−	−	+	24 hours
	+	−	−	−	+	5 days

EXPERIMENT NO. 3B

No. 1: 1-percent rabbit serum	+	±	−	−	+	24 hours
	+	±	−	−	+	48 hours
	+	+	−	−	+	3 days
No. 2: 1-percent rabbit serum	+	+	±	−	+	24 hours
	+	+	−	−	+	48 hours
No. 3: 1-percent human serum	+	±	−	−	+	24 hours
	+	±	−	−	+	48 hours
	+	±	−	−	+	7 days

EXPERIMENT NO. 4A

CARRIER: Scissors

CULTURE: Mixed Staphylococcus aureus, pneumococcus, streptococcus, + 5-percent whole blood

Sterilizing Solution	Duration of Exposure to Sterilizing Solution					Control	Incubation Period
	½ min.	1 min.	3 min.	5 min.	10 min.		
No. 1	+	+	+	−	−	+	24 hours
	+	+	+	±	−	+	48 hours
	+	+	+	−	−	+	3½ days
No. 2	+	+	±	−	−	+	24 hours
	+	+	−	−	−	+	48 hours
	+	+	−	−	−	+	3½ days
No. 3	+	−	−	−	−	+	24 hours
	+	−	−	−	−	+	48 hours
	+	+	−	−	−	+	5 days

EXPERIMENT NO. 4B

No. 1	+	±	±	−	−	+	24 hours
	+	+	+	±	−	+	48 hours
	+	+	+	+	−	+	3 days
No. 2	+	+	+	+	+	+	24 hours
	+	+	+	+	+	+	48 hours
No. 3	+	+	−	−	−	+	24 hours
	+	+	−	−	−	+	48 hours
	+	+	−	−	−	+	7 days

Experiment no. 5 showed that solutions nos. 1 and 2 destroyed a four-day-old spore-bearing culture of the hay bacillus when 3-inch sections of silk surgical thread infected with this culture were exposed to the action of these solutions for periods of 10 minutes or longer, but that solution no. 3 required only six minutes to destroy the spores of this organism. In another series of experiments with solution no. 3 upon the same culture, substituting gauze squares for the silk thread, all organisms were killed in two minutes. A resistant film of wax, or shellac, covering the suture material probably accounted for the greater length of time necessary to sterilize this carrier.

EXPERIMENT NO. 5

CARRIER: Silk, treated with paraffin — CULTURE: Four-day hay bacillus

Sterilizing Solution	Duration of Exposure to Sterilizing Solution					Control	Incubation Period
	2 min.	4 min.	5 min.	6 min.	10 min.		
No. 1	+		+		−	+	24 hours
	+		+		−	+	48 hours
	+		+		−	+	6 days
No. 2	+		−		−	+	24 hours
	+		−		−	+	48 hours
	+		+		−	+	6 days
CARRIER: Silk, treated with paraffin							
No. 3	+	+		−	−	+	24 hours
	+	+		−	−	+	48 hours
	+	+		−	−	+	5 days
CARRIER: Gauze squares							
No. 3	+	−		−	−	+	24 hours
	+	−		−	−	+	48 hours
	+	−		−	−	+	5 days

That variations in the virulence of organisms tested can also result in marked differences in the length of the sterilizing period was illustrated by the increase in time required to destroy a 10-day-old virulent, heavily grown strain of this same hay bacillus, no less than 14 to 16 minutes' immersion in solution no. 3 being necessary. It is almost inconceivable that such severe conditions of infection as this could be encountered in the usual routine of operating-room experience. In fact, all these experiments have been carried out under circumstances of far greater severity of infection than those likely to be met with in actual practice. The variation in results points out, however, that we cannot be too dogmatic in stating that this solution, or any solution, will definitely sterilize an instrument in so many minutes, as it is conceivable that circumstances can arise that may lengthen this period considerably. We feel, however, that if the metal instruments ordinarily used in ophthalmic operations are immersed for five minutes in solution no. 3, they may be regarded as sterile. It is our custom, nevertheless, to keep sharp instruments in this germicide for from 15 minutes to a half hour before performing an operation.

The question as to whether such lengthy immersion is likely to injure the instruments or to destroy their sharp edges brings us to the second part of our research problem. A few illustrations will, we believe, give substantial proof that no material injury will follow exposure of these instruments to these solutions for periods of several weeks. Photomicro-

graphs made of an ordinary stainable-steel cataract-knife blade are shown first as it came from the instrument maker, and later, after 24 hours' immersion in solution no. 3, when no change is seen as a result of this contact with the solution. After taking the last photograph this knife was returned to the germicide, and was allowed to remain there for a period

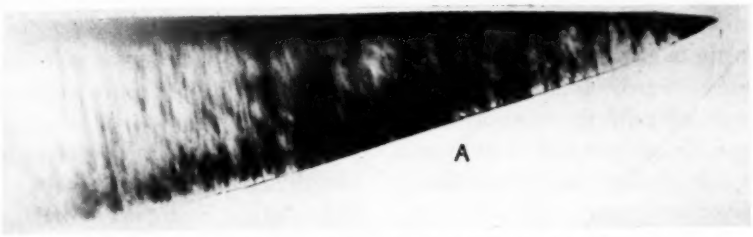

Fig. 1 (M. H. Post). Microphotograph of knife blade before immersion in solution no. 3.

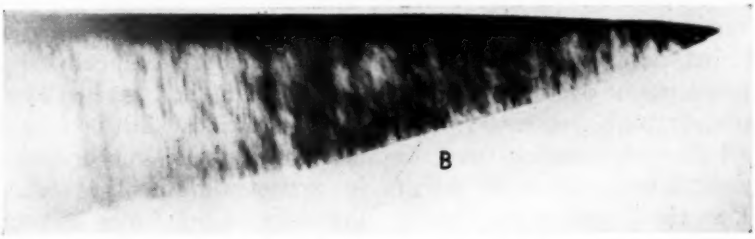

Fig. 2 (M. H. Post). Microphotograph of knife blade after 24 hours' immersion in solution no. 3.

of about three months. About 10 days later another knife of similar construction was placed in another test tube containing the same solution. Both knives were equipped with nickeled brass handles. The blade of neither knife showed any deterioration. The handles of the knives were fixed into the corks plugging the tubes. A portion of the handles, therefore, protruded above the level of the solution. After about two weeks this exposed portion showed some etching. Raising the height of the solution failed to check the progress of this change. The second knife showed slight decomposition of the nickel plating in the submerged portion after one month's time. A third knife, furnished with an aluminum handle, after four weeks' immersion in the same solution as the two other knives, remained entirely free from change of any sort. Finally, a fourth knife, immersed in solution no. 2 for the same length of time, is still in perfect condition.

In our experience all three of these preparations are not injurious to the instrument blades, but, in fact, act as preservatives and help to retain the brightness and the edges of the knives. On this account it is our custom, after cleaning a knife, and before putting it away, to wipe it off with a bit of cotton dipped in any one of these solutions, much as might be done with liquid albolene or oil.

As rubber gloves are, of necessity, frequently exposed to the action of whatever bactericidal agent is used, it was deemed best to investigate the effect of these solutions on both white and black rubber. Black rubber was partially decolorized after a few days' immersion in solution no. 2, but was unaffected by solution no. 3. No change could be observed in white

rubber after many weeks. Following several months' exposure, slight swelling and loss of tone could be noted. A number of plastics, on the other hand, have rapidly been destroyed by all three solutions.

The effect upon the skin of the hands has also been studied with interest. The reaction of assistants and nurses in this respect has been carefully noted. The general comment, as regards solution no. 3, has been quite favorable.

It would obviously be dangerous to allow any quantity of these solutions to enter the eye, as serious reactions would probably result. Before operation, therefor, the instruments must either be carefully wiped off after removal from the solution, or be plunged momentarily into sterile water to remove any remaining drops of the solution from them. The danger of rust development from this procedure must not be overlooked; here, again, careful drying is necessary. The possibility of carrying infection from the hands or arms by wet instruments is well understood, so the objection that drying instruments before using them may be detrimental to the preservation of their edges as a result of mechanical injury is more than overcome by the increased safety resulting therefrom. As a consequence, it seems that, in the case of complicated instruments that are likely to carry particles of the disinfectant, a momentary water bath is not only wise, but almost necessary.

From the foregoing protocols and experiments, it appears that all three solutions can be recommended as fulfilling both requirements herein set forth. Solution no. 2 is somewhat more effective than solution no. 1, whereas solution no. 3 is far more highly germicidal than either of the other two, and on that account is preferable to either of them, despite the fact that, after excessively long exposure, this solution is slightly more injurious to instrument handles of certain composition. Moreover, it is easily prepared at a relatively low cost by any pharmacist. It has a highly germicidal action, and can be used a number of times without fear of deterioration. For practical purposes, it has no injurious effect upon sharp instruments, the skin, or rubber gloves brought in contact with it. We feel, therefore, that solution no. 3 may be employed for the sterilization of all sharp-edged instruments to be used in any type of operative procedure.

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Discussion

Dr. W. B. Lancaster, Boston, Massachusetts: Dr. Post, in his abstract, said nothing about the objections to boiling. I have been an advocate of boiling for many years, but have not recently done any research work. I should like to call attention to the danger of tarnishing or possibly of oxidation. I am not sure about the chemical change that may occur from boiling. When I joined the Eye and Ear Infirmary about 45 years ago, I asked the operating-room nurse to let me boil my instruments. "No," she said, "it spoils the instruments to boil them." In my cocksure way I said, "Oh, no! I have boiled them a good many times, and it does not hurt them." So she took a new cataract knife, put some soda in the water in the sterilizer, added more water, and after boiling she took the cataract knife out and showed me that the nice, shiny blade had become gray and tarnished. She had proved her point, but I said, "You cannot boil instruments in *that* sterilizer; I will bring one in and show you it can be done." I secured an enamelware container

and boiled some knives and various other steel articles for many hours without any tarnishing. We then examined the first sterilizer. It was made of tinned copper, the inside being the tinned surface, which was mostly worn off; the bottom, which had evidently leaked, had been repaired with large quantities of solder, so that a heavy layer of solder was all around the container. These were the conditions which Dr. Post speaks of as alloys: we had the lead, the tin, and the copper, the steel of the knife, and the alkaline solution boiling, which together evidently caused the tarnishing. When we used the enamelware dish or sterilizer we had not that trouble. At that time knives were made with bone handles; later the handles were made of aluminum and various kinds of metal. If a knife is boiled for any length of time in an alkaline solution, the aluminum handle will be dissolved, for aluminum is soluble in alkalis, but not in acids.

However, it must be emphasized that it is not necessary to boil instruments for a long time in order to sterilize them. When we were working on that problem, I employed a number of small machine screws, choosing them because they were rough, and because bacteria could be well protected in the crevices. The screws were dipped in a mixed culture of various bacteria and dried. In the test they were boiled for 5, 10, 20, and 30 seconds, 1 minute, 5 minutes, and 10 minutes, and after boiling, the screws were dropped into a tube of culture medium. These were turned over to Dr. Verhoeff, who was then in charge of the laboratory at the Massachusetts Eye and Ear Infirmary. To our surprise, when the tubes were examined a few days later they were all turbid except one. Even those in which the screws had been boiled for 10 minutes were turbid. The one that was not contained a brass screw, while the others all held steel screws. Dr. Verhoeff was interested enough to examine cultures in order to see what organism could have grown and made the medium turbid in spite of that treatment, so he made subcultures, every one of which was sterile. The turbidity was simply oxidation of the steel screw; in other words, five seconds sufficed to sterilize every one of those specimens. It is quite unnecessary to boil a knife for five minutes, or even for one minute. What we do is to have the nurse dip the knife into the boiling soda for from 15 to 20 seconds; that is more effective—far more effective—as a sterilizing agent than putting the knife in alcohol for 10 or 15 minutes. Of course, Dr. Post's solution is much more effective than alcohol. I think it is an advantage if we can get away from these solutions. I have so much confidence in the effectiveness of boiling—it is so simple—that I still adhere to that as a good method, although I freely admit that Dr. Post's is also a good method.

Dr. Sanford R. Gifford, Chicago, Illinois: May I ask Dr. Post whether he means formaldehyde or formalin in his solution no. 3? There seems to be a little confusion in the label, formaldehyde being a gas, and formalin a solution of formaldehyde.

Dr. John Green, Saint Louis, Missouri: Dr. Post's solution no. 1 has been in use in the Saint Louis City Hospital Eye Clinic and operating room for a number of years. All cutting instruments are immersed in this solution for 15 minutes. All others are boiled. The majority of the eye operations have been cataract extractions, many on extremely old, poorly nourished, and decrepit individuals. The hospital has an excellent record in freedom from postoperative infections—evidence of the efficiency of the chemical and heat sterilization.

Instruments freshly sharpened by the

instrument maker are often returned to the surgeon coated with oil or vaseline. I have been surprised to see some surgeons and nurses place these oil-coated instruments directly into the chemical sterilizer. Is there any assurance that the chemical penetrates the oily film and reaches the surface of the knife or scissors? It has been my practice to remove all oily film by a thorough washing in hot soapsuds and by rinsing the instruments in sterile water before immersing them in the chemical.

DR. M. HAYWARD POST, closing: I have the greatest regard for anything that Dr. Lancaster has to say. Incidentally, in his paper which appeared in the Archives of Ophthalmology, 1901, v. 30, no. 4, Dr. Lancaster stated: "It is well known that knives may be boiled in water, especially in alkaline solutions, provided no electrolytic action takes place." I myself boiled these knives in dishes made of Pyrex and Bakelite. Apparently the difficulty arises in the composition of the knife handles. I do not believe the average ophthalmologist will know enough concerning their composition to make boiling a safe procedure. Either the knife blade or the handle seems to have been injured in most of our experiments, so I feel that this is a precarious procedure for the average operator. Of course, boiling periods much shorter than those I used—15 minutes or longer—are practical. The first three knives shown were boiled months ago, and at that time were in good condition, but when examined a short while ago the third knife blade had taken on a bluish appearance and had lost its edge to some extent.

As to alcohol alone, Dr. Ewing determined that 95-percent alcohol produced considerable rust on wire nails after a period of three weeks.

In reply to Dr. Gifford's question about the formaldehyde component, formaldehyde U.S.P. is identical with liquor formaldehyde and formalin, the latter at first a trade name, but now official U.S.P. All contain 37 percent of formaldehyde gas in aqueous solution.

THE ANTIBACTERIAL ACTION OF TEARS ON STAPHYLOCOCCI*

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To explain the comparative rarity of postoperative ocular infections and the relative scarcity of bacteria on the normal conjunctivae, an antibacterial action of tears† was postulated many years ago. Numerous attempts have been made since then to demonstrate such an action. Most workers used essentially the same technique, which consisted of inoculating various numbers of the organisms to be tested into small volumes of diluted or undiluted tears and plating out constant amounts of the mixtures at intervals during incubation. Bernheim,[1] Bach,[2] Marthen,[3] Ahlstroem,[4] Helleberg,[5] Lindahl,[6] and Meissner[7] all found that staphylococci were killed or inhibited to various degrees by tears but disagreed as to the explanation thereof. Bach[2] and also Ahlstroem[4] considered the inhibiting effect to be merely the result of the poor nutritive quality of the tears. However, Marthen,[3] Helleberg,[5] and also Lindahl[6] added small amounts of broth to the tears and controlled their experiments with saline containing the same amounts of broth. They obtained growth in the latter but not in the tears. Bernheim[1] and Helleberg[5] stressed the importance of the number of organisms inoculated: with too large an inoculum the antibacterial effect was masked. Axenfeld,[8] in his book in 1908, minimized the importance of any antibacterial action of tears but did, somewhat grudgingly, admit that pyogenic staphylococci appeared to be inhibited by them. Regarding other organisms, Axenfeld was probably justified in his attitude, since fewer tests had been done with them and the results of these had been very contradictory.[9]

Ridley[10] in 1928 confirmed the inhibition of staphylococci by tears and also found that hemolytic streptococci, pneumococci, and cholera vibrios were inhibited. Colon and typhoid bacilli were not affected. He showed that a slight decrease in tear concentration resulted in a complete loss of the antibacterial action. Ninety-percent tear concentrations killed pneumococci, but these organisms grew in 75-percent concentrations.

Fleming[11] in 1922 had shown that tears contained lysozyme, the enzyme that dissolves many air saprophytes very rapidly and completely. He had also reported that a number of pathogenic organisms were visibly dissolved by tears. Fleming and Ridley assumed that the actions of tears against pathogenic organisms were also brought about by the lysozyme of the tears. In view of the high concentrations of lysozyme present in human tears, such an assumption may have a certain justification but, as already noted, tears are fairly complex substances, containing materials arising from several sources, and the assumption should not be allowed to remain unverified if verification or refutation is possible. The work of Meyer *et al.*,[12] confirmed by others, showed that lysozyme is a basic protein or polypeptide enzyme of small molecular size and that it is soluble and extremely heat resistant in acid solution. This outstanding acid-heat

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† Tears as usually obtained from the conjunctivae are mixtures of lacrimal and conjunctival secretions, containing exfoliated epithelial cells, occasional leukocytes, and possibly some meibomian secretion. The relative proportions of the various constituents, are, necessarily, changed by inflammation or by irritative procedures used to stimulate tear flow.

stability offered a possible means of separating it from other antibacterial agents that might be present in the tears.

In the work reported here we attempted (1) to confirm or deny the antibacterial activity of tears against staphylococci; (2) to determine whether pathogenic (orange, mannite-fermenting, coagulase-producing) staphylococci were less susceptible to this action than the non-pathogenic types; (3) to find out whether the agent or agents active against staphylococci resembled lysozyme in acid-heat stability.

Methods

Tears were obtained from a number of individuals and pooled. Tear flow was stimulated by holding a wide-mouthed bottle containing recently crushed onions close to the eye. The tears were collected by means of suction, into a small tube through a capillary extension arm. About 0.2 to 0.3 c.c. could be collected from one individual.

The staphylococci to be tested were classified by pigment production and by testing for mannitol fermentation and for the production of coagulase. It is now generally recognized[13] that orange, mannitol-fermenting, coagulase-producing staphylococci are much more likely to be pathogenic than are white staphylococci that do not have these properties. Diluted 18-hour broth cultures were used for inoculation of the tear mixtures.

Fifty-percent and 25-percent dilutions of tears in infusion broth were used. Five hundredths of a cubic centimeter of the culture dilutions was added to 0.25 c.c. of the tear mixtures in small tubes, and to the same quantities of 50-percent saline-broth mixtures. The tubes were incubated at 37°C. for 18 hours. In all experiments the amount of clouding of the tear-mixture tubes was compared with that in the saline-broth control tubes. In a number of the experiments the growth was checked by plating out on agar plates uniform loops of the various mixtures at the beginning of the experiment and at the 3- or 6-hour and 18-hour periods.

In table 1 are shown the results in an illustrative experiment in which six strains of staphylococci were inoculated into two dilutions of tears and the

TABLE 1

Growth of staphylococci after 18 hours' incubation in tear-broth mixtures compared with growth in saline-broth controls

Staphylococcal Strain Number	In 50% Tear Broth			In 25% Tear Broth			In 50% Saline Broth		
	Dilution of Staphylococcal Culture Inoculated								
	1/100	1/1,000	1/10,000	1/100	1/1,000	1/10,000	1/100	1/1,000	1/10,000
1 P	1+	0	0	4+	4+	4+	4+	4+	4+
2 P	0	0	0	4+	4+	4+	4+	4+	4+
3 NP	0	0	0	4+	4+	2+	4+	4+	4+
4 NP	0	0	0	4+	3+	0	4+	4+	4+
5 NP	0	0	0	4+	3+	0	4+	4+	4+
6 NP	0	0	0	3+	3+	0	4+	4+	4+
7 NP	0	0	0	3+	3+	0	4+	4+	4+
8 NP	0	0	0	3+	2+	0	4+	4+	4+

4+ Heavy clouding.
3+ Clouding estimated three fourths of that in control tubes.
2+ Clouding estimated one half of that in control tubes.
1+ Clouding estimated one fourth of that in control tubes.
P Orange, Mannitol-fermenting, coagulase-producing strain.
NP White, Non-mannitol-fermenting non-coagulase-producing strain.

growths compared with those of the control saline-broth mixtures.

In table 2 is shown an experiment in which three strains of staphylococci were inoculated into 50-percent tear-broth and saline-broth mixtures, and the comparative growths determined by plating standard loops of the mixtures as well as by comparison of the clouding. The cultures were diluted 1 :1,000.

lysozyme in acid-heat stability the following experiments were made. Pooled human tears were divided into two equal portions. One portion was made just acid to congo red by one or two drops of N/1 HCL. It was placed in a 100°C. water bath for five minutes, then cooled and brought to pH 7.00 (nitrazine paper) by the addition of N/1 NaOH. The fresh and heated tears were then diluted with

TABLE 2

GROWTHS OF STAPHYLOCOCCI IN 50-PERCENT TEAR-BROTH AND 50-PERCENT SALINE-BROTH MIXTURES

Strain of Staphylococcus	Type of Observation	In 50% Tear Broth			In 50% Saline Broth		
		Time of observation or plating					
		Start	3 hrs.	18 hrs.	Start	3 hrs.	18 hrs.
9 P	Colonies growing from loop of mixture	52	60	—	100	4+	—
	Clouding of mixtures	0	0	1+	0	1+	4+
10 NP	Colonies growing from loop of mixture	90	>100	—	95	4+	—
	Clouding of mixtures	0	0	0	0	1+	4+
11 NP	Colonies growing from loop of mixture	>100	>100	—	>100	>100	—
	Clouding of mixture	0	0	0	0	1+	4+

P and NP As in table 1.
— Not plated.
>100 More than 100 colonies but growth on plate not confluent.
4+ Confluent growth on plates or clouding of broth equal to 18 hours' control.
1+ Slight clouding approximately one fourth of 18-hour control.
0 No colonies or no clouding.

In all, 16 strains of orange, mannitol-fermenting, and coagulase-producing staphylococci and 25 white, mannitol-coagulase-negative strains were tested. Fifteen of the former (orange) strains and all of the white strains were inhibited in the 50-percent tear dilutions. Not all strains were tested in the 25-percent tear mixtures; but in several experiments none of the orange strains were inhibited, while the higher dilutions of the white strains were usually completely inhibited.

To determine whether or not the anti-staphylococcal factor in tears resembled

broth and inoculations of the staphylococcal-culture dilutions made into them and in saline-broth controls, as in the previous experiments. The growth in the various tubes was determined both by plating and by direct observation of the degree of clouding. We have shown repeatedly that the lysozyme of egg white, saliva, or tears is not diminished in the slightest degree by the acid-heat treatment described. However, in the second of these experiments the lysozyme titers of the fresh and the heated tears were directly compared. This was done by measuring, photo-electrically, the diminu-

TABLE 3

GROWTH OF STAPHYLOCOCCI IN FRESH AND ACID-HEATED TEAR BROTH AND IN SALINE BROTH

Strain of Staphylococcus	Type of Observation	Time of Observation	50% Fresh Tear Broth			50% Acid-heated Tear Broth			50% Saline Broth		
			Dilutions* of Cultures Inoculated								
			1/100	1/1,000	1/10,000	1/100	1/1,000	1/10,000	1/100	1/1,000	1/10,000
42 P	Colonies from# loop of mixture	Start	98	60	19	50	26	11	78	42	7
		6 hrs.	35	20	0	4+	4+	4+	4+	4+	4+
		18 hrs.	>100	>100	>100	4+	4+	4+	4+	4+	4+
	Visible clouding	18 hrs.	0	0	0	4+	4+	4+	4+	4+	4+
43 NP	Colonies from loop of mixture	Start	50	27	14	60	10	3	26	6	3
		6 hrs.	0	0	0	4+	4+	4+	4+	4+	>100
		18 hrs.	2	20	30	4+	4+	4+	4+	4+	4+
	Visible clouding	18 hrs.	0	0	0	4+	4+	4+	4+	4+	4+
44 P	Colonies from loop of mixture	Start	77	55	15	112	69	18	103	58	16
		2 hrs.	30	45	6	>100	>100	>100	>100	>100	>100
		18 hrs.	12	2	0	4+	4+	4+	4+	4+	4+
	Visible clouding	18 hrs.	0	0	0	4+	4+	4+	4+	4+	4+
45 NP	Colonies from loop of mixture	Start	37	9	2	31	11	4	55	26	8
		2 hrs.	16	7	4	>100	45	38	>100	>100	32
		18 hrs.	10	1	13	4+	4+	4+	4+	4+	4+
	Visible clouding	18 hrs.	0	0	0	4+	4+	4+	4+	4+	4+

4+ Confluent growth on plate or marked clouding of mixtures.
>100 More than 100 colonies but not confluent growth.
0 No growth on plate or no clouding of broth.
* Failure of the number of colonies from the starting materials to diminish in proportion to the dilution was due to the use of only one pipette for each series.
# Plated on surface of agar plate.
P and NP as in previous charts.

tion in opacity of a standard suspension of micrococci* produced by 0.1-c.c. amounts of the heated and unheated tears. Numerous tests with various known concentrations of egg-white lysozyme have shown that by this method the lysozyme concentration of two solutions may be compared very accurately when they are tested upon portions of the same suspension of micrococci. The results of the two experiments are shown in table 3.

As in the previous experiments the 50-percent dilutions of fresh tears inhibited the growth of both types of staphylococci and even caused a diminution in numbers in some tubes. In the acid-heated tears, however, the organisms grew as well as in the saline-broth mixtures. The lysozyme concentrations in the fresh and heated tears used in the second of these experiments were shown by direct measurements to be exactly the same. Although they were not measured in the first experiment we know, as a result of innumerable tests with tears or other lysozyme-containing materials treated in exactly the same manner, that in this experiment, too, the heated tears contained just as much active lysozyme as did the fresh tears.

Discussion

The inhibiting effect of tears against both pathogenic and nonpathogenic types of staphylococci was clearly demonstrated. The possibility that the effective agent originated in the onion vapors dissolved in the tears was not ruled out, but it is not very probable that the antibacterial property was acquired in this way, since Ridley had similar results with tears stimulated by lemon juice. Previous workers have shown that tears stimulated by other methods also had inhibiting properties. The free growth of the organisms in the saline-broth control tubes eliminates all possibility that the inhibition in the tear-broth dilutions was due to lack of nutrition.

The nonpathogenic staphylococci were apparently more susceptible to the action of tears than were the pathogenic. The rapid disappearance of antibacterial activity with dilutions of the tears confirms previous reports. The destruction, by heating the acidified tears, of the anti-staphylococcal activity without affecting to the slightest degree the lysozyme content of the tears was clearly demonstrated and leaves no doubt that the lysozyme alone is not the agent responsible for this activity. It is possible that the lysozyme together with some labile agent plays a part, but evidence for this is yet to be brought forward.

Summary

An inhibiting action of tears against staphylococci was clearly demonstrated. Fifty-percent concentrations of the tears in broth inhibited the growth of 15 of 16 orange, mannitol-fermenting, coagulase-producing staphylococci, but these organisms grew well in 25-percent tear concentrations. All of 25 white, non-mannitol-fermenting, non-coagulase-producing staphylococci were inhibited by 50-percent tear concentrations; a number of the white strains were inhibited by 25-percent tear concentrations.

The action of tears against the staphylococci was not due to lysozyme, since heated, acidified tears lost all trace of anti-staphylococcal action, although the lysozyme content was unaffected by the heating.

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* M. lysodeikticus, the micrococcus isolated and named by Fleming, was used in these measurements. This organism is rapidly dissolved by minute concentrations of lysozyme from any source.

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PRACTICAL COMMENTS ON REFRACTION*

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It is not my intention to tell my hearers how to refract. This paper is made up merely of practical comments intended to emphasize certain points that, in my opinion, are important and therefore worth repeating. No other part of an eye examination will be considered.

Refraction is a word for the neutralization of ocular focal errors, by lenses, to the end that the sum of both makes the equivalent of an emmetropic condition. It differs from the neutralization of an unknown lens only in that in the latter case the total make a plane glass. The principle is the same. Refraction is harder merely because we have to deal with a mind (?).

It is difficult to make patients understand that our detailed examination is intended to find the lens that, by neutralizing their errors, "fits" the eye. Many seem to think that we prescribe any lens that strikes our fancy. Many have the notion that vision can be improved by "stronger" lenses just because they are stronger. They do not seem to understand that our examination is merely a systematized way of placing lenses before their eyes so that they may choose the ones they see with the best.

While one need not be a genius to be a good refractionist he must have the essential quality of one—"An infinite capacity for taking pains." Also, almost an infinite amount of patience is needed. *The desire to be accurate must be in his makeup.* Refraction should not be looked upon as a necessary evil. It has been truly said that *our reputations are made or unmade by the quality of our refraction.* I look on every case as a puzzle to be worked out—the harder it is the more interesting and the greater my intention not to let it "get me down."

Many ophthalmologists have admitted to me that they stop the examination with a lens that gives 20/20 vision. Such a result is not accurate if further effort would secure 20/16, 20/13, or 20/10. In other words, *the examination should be continued until the very best possible vision is obtained.*

In an eye free from pathologic conditions it is so easy to reach 20/20 that I consider my refraction test really begins

* Read before the Western Ophthalmological Society in Los Angeles, January, 1940.

at that point. Practically all normal eyes can be made to see 20/13. When this vision is obtained one can be sure that all astigmatism is corrected, also spherical errors within the limits of paralysis of accommodation by a cycloplegic or of voluntary relaxation if none is used.

A patient with ordinary powers of observation should notice a blur on 20/13 letters when a 0.25 D.cyl. is rotated as little as 10 degrees—many notice the blur with 5-degree rotation. On larger letters, say the 20/20 line, these fine differences are not noticed so plainly. The 20/20 line can be read with a 25 D.cyl. 90° out of position. One-eighth diopter cylinders and spheres make definite changes on the 20/13 line.

Every refractionist should learn the relation between visual defects and the strength of lens needed to neutralize them. He may then often obtain 20/20 vision with the first lens tried. Knowledge and use of this information usually give a faster start than retinoscopy and probably even faster than a refractor can be adjusted before the eye.

In my opinion speed in refraction depends more on how fast and how accurately the patient's mind works than on how fast lenses can be changed. For this reason there is no use in trying to outspeed the patient's mind.

One difficulty is to get patients to concentrate enough to listen to and answer simple questions such as, "What does this letter look like?" Many will answer like this, "Two weeks ago I was at the movies" and this or that happened. Some will say, "That glass is better but I don't see so well," which is typical of the accommodating pest who, for fear of hurting the examiner's feelings, tries to make every glass "better."

Many have to be *forced* to read because it is easier to say "I can't" than to try. By pointing to each letter many can be coaxed to read one, sometimes two, lines smaller. Another troublesome type is the one who will not hold his head up and look through the lens center. This is especially important, for an obvious reason, when lenses are high in power. Children's necks are often so flexible that a wet dish rag is a rigid thing in comparison. How such patients can be refracted with a refractor is beyond my imagination.

Some illustrative examples

1. A patient who reads 20/20 before and 20/200 under cycloplegia. Usually a plus 2 sphere will give 20/20 as a fast start.

2. One who reads 20/200 at manifest. Frequently a minus 2 sphere will give 20/20.

The drawback to working this way rather than by working up by 0.25 D. shifts is that the patient may think the whole affair is too simple.

3. A patient under 40 years of age with presbyopic symptoms frequently has considerable hyperopia even though, at the manifest, he accepts only minus lenses.

4. A patient who reads 20/20 is not myopic and has very little astigmatism.

The cross-cylinder rapidly locates the astigmatic axes, especially if the patient is able, by accommodation, to overcome the minus part of the combination.

Spherical aberration often accounts for inability to secure 20/20 or better with a dilated pupil. I saw a marked instance of this in a young man who read 20/13 easily at manifest but only 20/40 at cycloplegic test. But with a 4 mm. aperture he easily read 20/13. *Hence, the refraction should always wind up with use of the 4-mm. aperture.* The only trouble with it is the number of people who are unable to grasp the idea of looking through its center to avoid marginal

blurring. Some even ask "Where is the hole?"

The red-green test. Some years ago I was talked into buying this apparatus and used it as a check after quite a number of refractions. I gave it up because it merely verified my findings, thus proving my contenton that 20/13 vision means a perfect correction. So why bother with an unnecessary complication?

The central-color-vision test should always be used when a patient cannot be made to read 20/20 or better. By its use, some years ago, I picked up an early tobacco amblyopia in a young woman—so early that the symptoms were present only in one eye. Another oculist had diagnosed hysteria! Two weeks without tobacco and her central color scotoma for red was gone and vision was the same as in the other eye. Eyes with clear media can easily see red in 0.5-mm., blue in 2-mm., and green in 2-mm. size at 20 feet. By using this test beginning macular and optic-nerve changes can be quickly diagnosed.

In many people with pathologic conditions it is often impossible to get a start working at 20 feet, but by starting at 3 feet it is often astonishing what can be worked up. Recently, I had an old patient with small pupils and circular synechiae, the result of trephinings done many years ago. Scum on the lens capsule prevented an approximate refraction with the ophthalmoscope. By starting at three feet I was able to find lenses that gave 20/30 and ordinary print. To her this was as miraculous as sight secured by an operation.

I always neutralize, make a record of, and start the manifest examination with glasses the patient is wearing. They often give a quick start. Moreover, if none, or only a slight change can be found and the patient is definitely suffering from eye strain I at once investigate the ocular-muscle condition by prolonged occlusion.

Insignificant changes in lenses are to be avoided. Speaking of trifling changes, it is not rare to see prescriptions of 0.25 D. and 0.50 D. spheres and plus 0.25 D.cyl. axis 90° given by ophthalmologists. In my opinion such errors do not cause symptoms in prepresbyopic patients and therefore are a virtual admission that the cause of symptoms has not been found. It is not rare to have patients show two pairs of glasses, prescribed at different times, that are practically identical. I could recite thousands of cases to prove the value of prolonged occlusion, but this is not the time nor place, considering the title of the paper.

In the manifest examination it goes without saying that all pathological conditions should be found. Also, much time should be spent increasing the plus and decreasing the minus powers. After each eye is refracted I try pairs of plus 0.25 D. spheres and plus 0.50 D. spheres because many can relax the accommodation better binocularly than monocularly.

The ophthalmoscope often gives a very good idea of the refractive error. I have seen several old people diagnosed as cataract cases who, on using high minus lenses in the ophthalmoscope, turned out to be cases of lenticular myopia or "second sight."

When cycloplegia is not used, the manifest should be repeated on different days until consistent results are secured. This is better than to reëxamine later with a change in prescription. Moreover, if there is no doubt as to the accuracy of the correction, and the patient is still uncomfortable, one can at once go to the prolonged-occlusion test, which will usually locate the difficulty as a hidden muscle imbalance.

In examining babies, the ophthalmoscope often gives a rough idea. It will save anyone from the error of prescrib-

ing a plus 1 D. when the error is plus 6 D. When babies will not permit the use of a trial frame, lenses will have to be held in front of the eye working at 20 inches with the retinoscope. Care must be taken to hold them at right angles to the reflected light for obvious reasons. This caution is, of course, applicable in all refractions—subjective as well as retinoscopic. In adults I like to retinoscope the axes with cylinders, finishing with the sphero-cylinder combination. In doing this a plus 1 D. is in the rear cell, the cylinders in the rotating cell. Mixed astigmatism is found at once by two motions of the mirror.

Exceedingly accurate retinoscopy is not necessary. Within a half diopter is close enough for all practical purposes in those patients who cannot be finished by the subjective method. Having lost my middle-distance focus, I find plus 1 D. behind the sight hole helps me to see the shadow clearly.

When the best possible vision is secured the astigmatism is corrected, so I do not use dials or other black lines. When a patient can tell the difference between O, C, and D; F and P on the 20/13 line nothing more is needed. Whenever possible I prefer the axes found at the manifest test through the normal pupil with which, usually, the 4-mm. aperture test will agree. Cylinder axes should be located as closely as possible to either 90 degrees or 180 degrees, without sacrificing vision, to reduce the annoyance from too oblique placement of cylinders.

Cycloplegia is routinely used up to presbyopic age, and even then when results are not otherwise satisfactory. I have been refracting since 1900 and have never seen a hypertension from use of a mydriatic. I once refracted a woman in her middle fifties who disclosed a diopter more of sphere with atropine than with homatropine, and so obtained her *first* comfortable glasses. For the presbyopic and those approaching that stage, the hyperopic correction should be as close to full as possible. This is because with weak accommodation, low plus errors cause a disproportionate amount of strain.

Things essential in refraction

1. Something to look with—the anatomical eyes.

2. Something to interpret what the eyes see—the mind's eye. Upon the ability of the patient to use this depends the accuracy of the result.

3. An examiner interested enough to "go the limit." He must be interested enough to "force the issue." This is very often needed to make the patient concentrate. For example: A patient may read 20/20 easily but on going to 20/16 will say "I can't" rather than make an effort. When coaxed by pointing to each letter he may read them all. The patient must not be allowed to lie down on his part of the test. Frequently such forcing irritates them but, "What of it?" They will be more irritated if they are given wrong glasses because of failure to force the issue in the beginning.

It is a pleasure to refract people who are accustomed to make accurate comparisons, such as artists, draughtsmen, and mechanics.

4. Certain apparatus:

(a) Something to look at—usually letters. When perfect, clearly printed letters are available I can see no use in projecting them on a screen which calls for accurate focusing by the examiner. Usually the projection is on a silver screen the glare of which tends to blur by irradiation of the white over the black letters. The idea is the same as the optical illusion of a black disc on a white background which appears smaller than a white disc of the same size on a black

background. I still prefer the old 20th Century Cabinet with the letters printed on a linen roll so that only one line is presented at a time.

Illumination of the letters: I use a 100-watt light in a parabolic reflector and it gives perfect illumination in connection with the 20th Century Cabinet.

(b) Lenses. I prefer a trial case and use the B & L Precision Set, having never been tempted to use a refractor. The advantage claimed is the speed of lens changing but, as mentioned before, nothing is gained by trying to outspeed the patient's mind by rapid rotation of lenses. The only advantage that comes to mind is the freedom from polishing lenses.

(c) Instruments needed are the ophthalmoscope and retinoscope. I have never been able to get any satisfaction with an electric retinoscope, much preferring the plane mirror type. *In general I think we should reduce as much as possible the machine-shop appearance of an office.* Much apparatus has been forced on the profession by smooth salesmen. Too many ophthalmologists cope with optometrists who advertise the use of all the latest apparatus. Of course they overlook mentioning the fact that machines do not think. *The whole affair lies in the quality of gray matter, how well informed it is, and chiefly whether or not it will exert itself.* Patients who are impressed by the amount of apparatus in an office do not rate very high themselves. In a recent article Dr. Lancaster mentions an apparatus made by Zeiss, to sell for $600, to give the same results as his red-green spectacles and a tangent screen (cost about $55), and says that it "will be preferred by those who want complicated and expensive apparatus in their offices."

Being of the opinion that better work can be done if one is comfortable, I use a stool of such height as to bring my shoulders slightly above the eyes of the average patient, thus avoiding what the radio advertiser called the "stoop, squat, and squint" attitude. Its seat is covered with two layers of sponge rubber, which averts the squirming caused by hard contacts.

Directly in front are my hand slitlamp (Shahan), ophthalmoscope cord, small light for observing ocular rotations and pupillary reflections, and a high-power B & L prism binocular loupe. Therefore, my patient does not have to be moved from place to place in order to be mounted before an assortment of machines.

Hence, *I have to depend on good results rather than on impressions created by office fixtures.* In this connection I once remarked to an intelligent patient that I would like to have a practice made up entirely of intelligent people. His reply was, "Doc, it would be a very small practice."

450 Sutter Street.

EXPERIMENTAL ACUTE IRIDOCYCLITIS IN RABBITS PRODUCED BY COLIFORM BACTERIA ISOLATED FROM THE UPPER RESPIRATORY TRACT OF MAN*

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The determination of the etiology of acute and chronic inflammatory lesions of the uveal tract in man is still important in the problem of preventing blindness in spite of the thorough studies made by many observers.[1,2,3,4,5,6,7,8,9] A preliminary report was, therefore, presented in 1936,[10] on the production of acute iridocyclitis in rabbits by the intravenous injection of broth cultures of organisms isolated from the upper respiratory tract of man. These cultures were obtained from patients with inflammatory eye diseases and supposedly normal controls. Further studies of cultures from this source revealed that certain gram-negative bacilli, such as Bacillus coli, the nonlactose fermenters, and particularly those of the Aërogenes-Friedländer groups, produced iritis in rabbits more consistently and with smaller quantities of culture than did other organisms commonly found in the upper respiratory tract. Of 36 strains of upper-respiratory coliform bacilli injected in one series of experiments, 75 percent produced iridocyclitis when inoculated intravenously into rabbits; 14 percent killed the rabbits before observation, and only 11 percent failed to produce ocular pathology. For this reason and because 30 percent of 216 patients with inflammatory eye diseases showed gram-negative bacilli in the upper respiratory tract, a more extensive study of the iridocyclitis-producing property of these organisms was made.

CLASSIFICATION

From a survey of the literature it appears that, in the present stage of knowledge and because of the existing confusion of ideas, an acceptable classification of these gram-negative bacilli is difficult. Topley and Wilson[11] considered it unwise to attempt differentiation between Aërobacter aërogenes and Bacillus Friedländer on a basis of habitat alone; they also quoted Toenniesen as stating that nonmucoid variants of B. Friedländer, which resembled B. coli, frequently arose on cultivation. Julianelle[12] claimed to have differentiated A. aërogenes from B. Friedländer by the use of group-specific antigen. However, since the technique was complicated and did not clarify our knowledge concerning the B. coli group, in which we were equally interested, its use was considered impractical for our purposes. Parr[13] summarized previous classifications and suggested that, for the present, the Aërobacter, Escherichia, typhoid, Salmonelli, and Shigelli be placed within one interrelated group under the term "coliform bacteria." Because our investigation was concerned mainly with their pathologic significance, and since, at the present time a more detailed classification is unwarranted, these organisms will be referred to as "coli-

* Presented before the meeting of the American Ophthalmological Society, June 3, 4, 5, 1940, Hot Springs, Virginia. This study was aided by a grant from The Ophthalmological Foundation, Inc.

form bacteria. In 1916, Woods[3] repeated Guillery's experiments[2] with Bacillus prodigiosus and claimed to have produced chronic "infiltrative" uveitis. The fact (1) that this is a gram-negative coccobacillus, (2) that it is found at times in the intestinal tract, and (3) that certain of the animals seemed to develop immunity on repeated injections are points of similarity between the B. prodigiosus and the coliform group and the results obtained by Woods and by us.

Pathogenicity of coliform strains

The first indications of the unusual pathogenicity of these organisms for rabbits were observed in the high mortality and high incidence of iridocyclitis encountered when mixed cultures containing coliform bacilli and other bacteria from the upper respiratory tract were injected intravenously into rabbits. For this reason, pure cultures of the gram-negative organisms were injected into another series of rabbits. Although it was necessary to inject 5.0 c.c. of a 24-hour broth culture of an iridocyclitis-producing streptococcus in order to develop the maximum degree of iridocyclitis that the strain was capable of producing, 2.0 c.c. of an iridocyclitis-producing coliform was capable of causing the same reaction. Even with this small amount of culture the mortality was approximately 65 percent. In order to reduce the mortality, so that the rabbits could be observed over a longer period of time, smaller amounts were injected. It was found that from 0.3 c.c. to 0.5 c.c. of a 24-hour broth culture of an iridocyclitis-producing coliform strain caused the same degree of iridocyclitis as was obtained with 2.0 c.c. and the mortality was lower.

Production of iridocyclitis with coliform filtrates

Experimental studies on the production of eye diseases by the injection of filtrates of coliform bacteria have been made as early as 1903. Stock[1] injected five rabbits intravenously with daily injections of 0.1 c.c. of filtrates of colon bacilli, the number of injections varying from 6 to 33. Clinically and pathologically, following these injections, the eyes were normal.

In order to eliminate the possibility that the iridocyclitis produced in the rabbits used by us may have been caused by an accumulation of bacteria within the blood vessels of the iris and ciliary body, experiments with filtrates of these organisms were conducted. To determine that the culture medium did not of itself produce ocular nor general pathologic changes, intravenous injections in varying amounts were given with entirely negative results. An intravenous injection of 5.0 c.c. of a Seitz-filtered 24-hour brain-heart-infusion culture of an Aërogenes-Friedländer bacillus isolated from the nasopharynx of a patient was given each of 17 rabbits. All these rabbits developed iritis within five hours, the intensity ranging from one plus* to three plus, the majority developing a three-plus reaction. Three rabbits died within 3 hours, and four more within 76 hours. The unused portion of the filtrate was preserved with merthiolate 1:5000; one week later 5.0 c.c. was injected into each of the 10 rabbits surviving the first injection. Nine developed a two-plus and one a one-plus sector iritis. Three of the animals died within 76 hours. Two weeks after the first injection, the seven rabbits that sur-

* In recording the occurrence of iridocyclitis, the designation of one-, two-, three-, and four-plus indicates the degree of iridocyclitis produced. One-plus indicates a definite congestion in the vessels of the iris; two-plus indicates marked engorgement of the vessels in the iris; three-plus indicates marked congestion of the iris, marked circumcorneal congestion, edema, and clouding of the iris, with or without small hemorrhages; four-plus indicates the same clinical signs as three-plus, with the addition of exudate in the anterior chamber.

vived were reinjected with another 5.0 c.c. of the preserved filtrate. Of these, four developed a two-plus sector iritis, two a mild one-plus iritis, and one showed no inflammatory reaction. All of these rabbits survived. As controls, five normal rabbits were inoculated with the filtrate, which was then two weeks old. Two developed a mild two-plus iritis, two a plus-minus iritis, one showed no iritis, and all survived (table 1). These findings seem to indicate that the iritis produced by these organisms is not caused by an accumulation of bacterial cells within the irides, but is due to a filterable factor. Moreover, the strength of this iritis-producing factor of the filtrate tends to diminish with age, even in the presence of merthiolate. Similarly, cultures kept in broth and on nutrient agar showed a progressive loss of pathogenicity. There was marked reduction or complete elimination of the iritis-producing power of subcultures made from month-old cultures that had been preserved in the refrigerator (45°C.; table 2).

TABLE 1

THE PRODUCTION OF IRITIS IN RABBITS WITH INTRAVENOUS INJECTIONS OF 5.0 C.C. OF FILTRATE* PREPARED FROM THE CULTURE OF AN UPPER RESPIRATORY IRITIS-PRODUCING COLIFORM BACILLUS

Rabbit	June 30	July 7	July 14
1	Died in 1 hour		
2	+ iritis, O.U.—died in 2 hours		
3	+++ iritis, O.U.—died in 3 hours		
4	++ iritis, O.S. +++ iritis, O.D.	Sector iritis ++ and scleritis, O.U.	Iritis ++, O.U.
5	+++ iritis, O.U.	++ iritis—edema of the iris—congestion of capillaries in opaque nerve fibers—died in 2 days	
6	+++ iritis, O.U., died in 48 hours		
7	++ iritis, O.S. +++ iritis, O.D.	++ iritis—slight exudate in pupils—question of congestion of nerve—died in 3 days	
8	+ iritis, O.S. ++ iritis, O.D.	Sector iritis ++—died in 2 days	
9	+++ iritis, O.S.; died in 3 days ++ iritis, O.D.		
10	+++ iritis, O.U.—died in 2 days		
11	++ iritis, O.U.	Sector iritis +, O.U.	possible + iritis, O.U.
12	+++ iritis, O.S.—died in 2 days ++ iritis, O.D.		
13	++ iritis, O.U.	Sector iritis ++ and scleritis, O.U.	Iritis ++, O.U.
14	++ iritis, O.U.	++ mild iritis and scleritis, O.U.	Iritis ++, O.U.
15	+ iritis, O.U.	Sector iritis, O.U.	Iritis +, O.U.
16	+ iritis, O.S. ++ iritis, O.D.	Sector iritis ++ and scleritis, O.U.	Iritis ++, O.U.
17	++ iritis, O.U.	O.D., definite ++ iritis, not definite sector O.S., ++ iritis, not definite sector	No iritis

* Filtrate preserved with Merthiolate 1:5000.

IMMUNIZATION OF RABBITS TO COLIFORM BACTERIA

The possibility of rabbits developing an immunity to the iridocyclitis-producing factor was tested in the following way: A group of six rabbits was given small intravenous doses (0.3 c.c.) of a filtrate prepared from an iridocyclitis-producing A. aërogenes isolated from a throat culture. After the first injection all the animals developed an acute two-plus to three-plus iritis. Subsequent injections were given at intervals of from two to three days. Several of the animals devel-

oped a one-plus to two-plus iridocyclitis after the second injection, but after the next three injections no iridocyclitis was produced. After the fifth injection two rabbits died from unknown causes. The surviving four rabbits were given a sixth injection; at the same time two control rabbits were injected with a similar amount of the same filtrate. The immunized rabbits developed no iridocyclitis, whereas the control animals developed a one-plus iridocyclitis. Ten days after the last "immunizing" dose, one of the test rabbits was given 0.5 c.c. of a freshly isolated nasopharyngeal B. coli culture. A mild one-plus iridocyclitis was produced in from three to four hours, whereas a control rabbit receiving the

TABLE 2

TYPICAL LOSS OF IRIDOCYCLITIS-PRODUCING PROPERTY OF COLIFORM STRAINS

(An Aërogenes-Friedländer Bacillus from Nasopharynx)

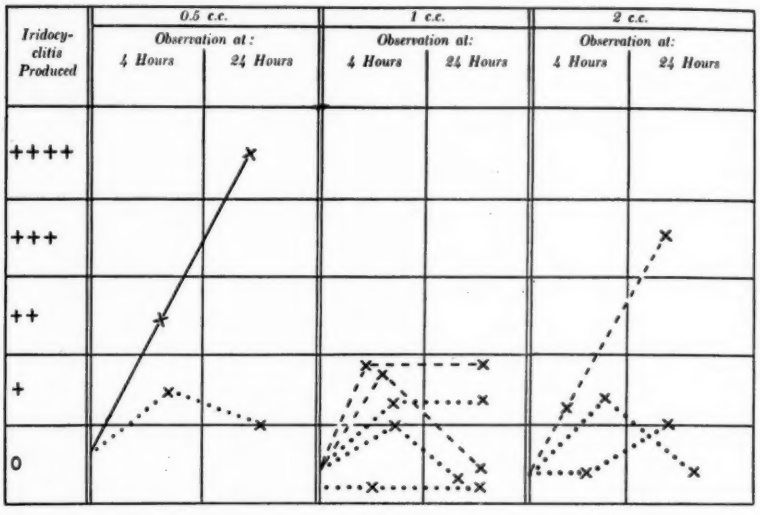

TABLE 3

IMMUNITY TO IRITIS PRODUCED IN RABBITS BY REPEATED INTRAVENOUS INJECTIONS OF 0.3 C.C. FILTRATE PREPARED FROM AN IRITIS-PRODUCING UPPER RESPIRATORY COLIFORM STRAIN

Inoculation Date	11/15	11/17	11/21	11/23	11/25	11/29
Test rabbit						
No. 812	++ iritis	No iritis	No iritis	No iritis	No iritis	No iritis
No. 813	+++ iritis	No iritis	No iritis	No iritis	No iritis	No iritis
No. 814	+++ iritis	++ iritis	No iritis	No iritis	No iritis	Dead
No. 815	+++ iritis	+ iritis	No iritis	No iritis	No iritis	No iritis
No. 816	++ iritis	No iritis	No iritis	No iritis	No iritis	Dead
No. 817	++ iritis	++ iritis	No iritis	No iritis	No iritis	No iritis
Control rabbit						
No. 818	No injection	No injection	No injection	No injection	No injection	+ iritis
No. 819	No injection	No injection	No injection	No injection	No injection	+ iritis

same amount of the culture developed a marked two-plus iridocyclitis.

Six weeks after the last "immunizing" dose another of the test animals was injected with 1.0 c.c. of a culture of A. aërogenes, freshly isolated from a throat culture. A one-plus iridocyclitis developed in three hours; this quickly subsided and no congestion of the iris was observable after 24 hours. A control rabbit which was given the same amount of the culture developed a two-plus iridocyclitis in three hours, which was still one plus after 24 hours. These experiments were repeated, using cultures instead of filtrates, with similar results. Variations were made in the intervals between injections, and in the number of injections, and in the amounts injected, all without variation in results. This was true of both filtrates and cultures. From these experiments it seems possible to immunize rabbits to these coliform bacilli, although, with the dosage schedules used, the immunity produced may be partial, or transitory, or both (tables 3 and 4). This observation agrees with the recent findings of Sanders.[14]

TABLE 4

REACTION OF IMMUNIZED* RABBITS TO SUBSEQUENT INTRAVENOUS INJECTIONS OF FRESHLY ISOLATED UPPER-RESPIRATORY COLIFORM CULTURES

	Number of Previous Injections	Days Since Last Injection	Amount of Fresh Culture	Reaction
Test Rabbit No. 812	6	2	1.0 c.c.	+ iritis in 3 hours—negative in 24 hours
Control Rabbit No. 818	0	—	1.0 c.c.	++ iritis in 3 hours— + iritis in 24 hours
Test Rabbit No. 563	1	21	1.0 c.c.	+ iritis in 4 hours—subsiding in 24 hours
Control Rabbit No. 574	0	—	1.0 c.c.	++ iritis in 4 hours—dead in 18 hours
Test Rabbit No. 807	1	4	0.5 c.c.	Doubtful iritis in 3 and 18 hours
Control Rabbit No. 810	0	—	0.5 c.c.	+++ iritis in 3 hours; ++ in 18 hours
Test Rabbit No. 809	1	4	0.3 c.c.	Doubtful iritis in 3 and 18 hours
Control Rabbit No. 811	0	—	0.3 c.c.	++ iritis in 3 and 18 hours
Test Rabbit No. 873	3	3	0.3 c.c.	No iritis in 4 and 24 hours
Control Rabbit No. 886	0	—	0.3 c.c.	++ iritis in 4 hours; + iritis in 24 hours
Test Rabbit No. 874	4	3	0.3 c.c.	Doubtful iritis in 4 hours; negative in 24 hours
Control Rabbit No. 886	0	—	0.3 c.c.	++ iritis in 4 hours; + iritis in 24 hours
Test Rabbits Nos. 876, 877, 879, and 880	3	44	0.3 c.c.	All negative for iritis in 4 and 24 hours
Control Rabbits Nos. 884 and 885	0	—	0.3 c.c.	++ iritis in 4 hours, + iritis in 24 hours

* Rabbits having received one or more small intravenous doses of either culture or filtrate of an iritis-producing upper respiratory coliform bacillus.

TABLE 5

COMPARISON OF IRIDOCYCLITIS-PRODUCING PROPERTY OF UPPER RESPIRATORY AND FECAL COLIFORM BACTERIA (AËROGENES-FRIEDLÄNDER) USING 0.5 C.C. OF A 24-HOUR CULTURE INJECTED INTRAVENOUSLY IN RABBITS

Rabbit No.	Intensity of Iridocyclitis Produced by Upper-Respiratory Strains		Intensity of Iridocyclitis Produced by Fecal Strains		Rabbit No.
	4 Hours	24 Hours	4 Hours	24 Hours	
1	++	0	0	0	12
2	++	++	0	0	13
3	++	+	± (½)	0	14
4	+	++	± (½)	0	15
5	++	+	+	+	16
6	++	++	0	0	17
7	++	+	+	+	18
8	++	Dead	+ (½)	+	19
9	++	+ dead in 48 hours	+	++	20
10	++	++			
11	+++	++ dead in 30 hours			
Average Intensity	2.0 plus	1.4 plus	0.5 plus	0.55 plus	
Mortality		27 percent		0 percent	

INTENSITY OF IRIDOCYCLYTIS PRODUCED BY CULTURES COMPARED WITH THAT PRODUCED BY THEIR FILTRATES

In order to determine whether a filtrate could produce as intense an iridocyclitis as the culture from which it was obtained, when given in equal amounts, two rabbits were injected intravenously with 5.0 c.c. of an Aërogenes-Friedländer culture. The strain used was one that had recently been isolated from the aqueous of a patient with uveitis. Both rabbits developed a three-plus iridocyclitis. A freshly prepared filtrate from the same strain also produced a three-plus iridocyclitis when 5.0 c.c. was similarly injected into two other rabbits. Using the same strain, the experiment was repeated with 3.0-c.c., 1.5-c.c. and 0.5-c.c. amounts of culture and filtrate. In each instance the result of the intravenous injection of culture was similar to that obtained when the same amount of filtrate was injected. Other strains were tested in the same manner. and the results seemed to indicate that practically all of the iridocyclitis-producing factor was filterable. However, no experiments were carried out with the filtered organisms, thus making a definite conclusion impossible.

COMPARISON OF PATHOGENICITY OF UPPER RESPIRATORY COLIFORMS WITH FECAL COLIFORM STRAINS

The iridocyclitis-producing power of these upper-respiratory strains was compared with that of miscellaneous coliform bacteria isolated from the feces of other patients. Eleven rabbits, injected with 5.0 c.c. of 24-hour broth cultures of strains isolated from the upper respiratory tract, averaged two-plus in from four to five hours and 1.4-plus in 24 hours, with a mortality of 27 percent (table 5). In contrast, nine rabbits injected with similar amounts of miscellaneous fecal coliform cultures showed an average intensity of 0.5-plus iridocyclitis in four to five hours and a 0.55-plus in 24 hours, with no deaths. These findings suggest the possibility that upper-respiratory coliforms may be more toxic than fecal strains.

OCULAR PATHOLOGY OBSERVED IN CERTAIN EXPERIMENTAL ANIMALS

Iridocyclitis was produced in a rabbit 48 hours after the intravenous injection

of 0.5 c.c. of Paratyphoid A filtrate (fig. 1). The cornea and sclera were not involved in the pathologic process. Eosinophilic material, which is protein in nature, was present in the anterior and posterior chambers. The iris was edematous and was infiltrated with a few polymorphonuclear leukocytes and a rare monocyte. The ciliary body and processes were slightly swollen and were separated from the choroid. The optic nerve was not shown on this section. The periorbital tissues showed no changes.

Iridocyclitis was produced in a rabbit's eye after the intravenous injection of 5.0 c.c. of a pure 18-hour brain-heart-infusion culture of A. aërogenes obtained from a patient's nasal culture. A four-

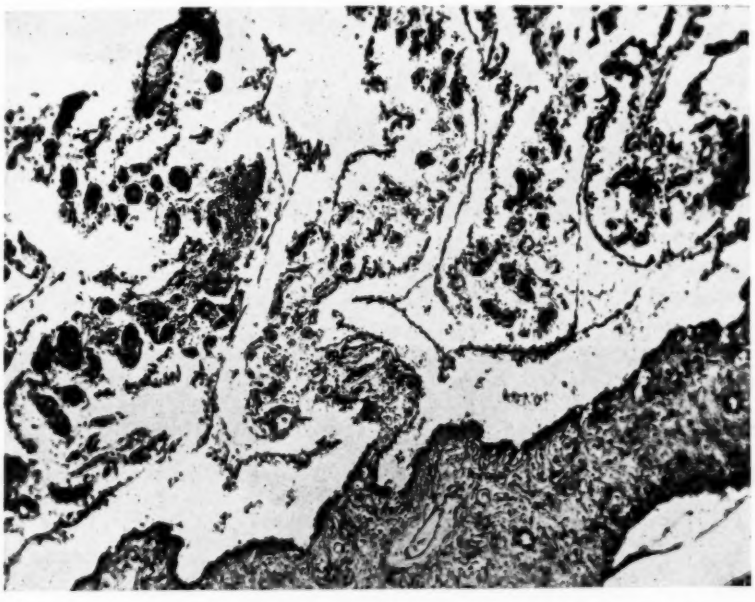

Fig. 1 (Berens and Nilson). Acute iridocyclitis in rabbit's eye 48 hours after an intravenous injection of Paratyphoid A filtrate (0.5 c.c.). There was no obvious external reaction at 4 hours in the eye, but a 4+ iridocyclitis was observed at 48 hours.

were distorted, edematous, and contained many neutrophils and free red blood cells. The ciliary epithelium was edematous and destroyed in many places. The small ciliary vessels were engorged and some were ruptured. Small vesicles that contained serum, fibrin, and neutrophils were formed from the stripped epithelium of the ciliary body and processes. The vessels of the choroid near the anterior part of the uveal tract were engorged with red blood cells, but the remainder of the choroidal vessels were normal. The layers of the retina

plus iridocyclitis was produced in five hours (fig. 2). The ciliary body and iris were markedly congested. An albuminous exudate appeared in the anterior chamber; the choroidal vessels were engorged. The retina was normal. Pigment granules were present in the anterior chamber. There was no lymphocytic infiltration in the ciliary body. Scattered polymorphonuclear lymphocytes were observed in the exudate in the anterior chamber.

Acute congestive iridocyclitis with albuminous exudate in the anterior cham-

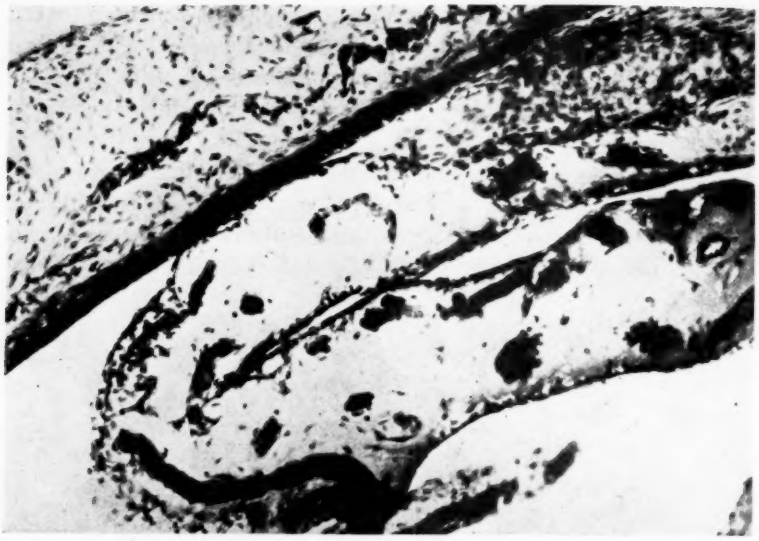

Fig. 2 (Berens and Nilson). Iridocyclitis (4+) in rabbit's eye after intravenous injection of 5.0 c.c. of a pure 18-hour brain-heart-infusion culture of A. aërogenes obtained from a patient's nasal culture.

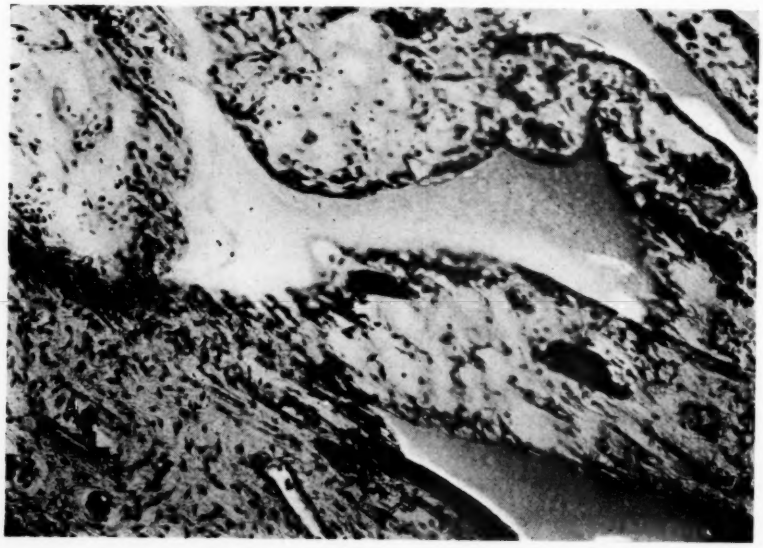

Fig. 3 (Berens and Nilson). Acute congestive iridocyclitis (4+) with albuminous exudate in the anterior chamber containing some polymorphonuclear leukocytes in rabbit's eye after intravenous injection of 5.0 c.c. of a filtrate prepared from a 24-hour culture of A. aërogenes obtained from a patient's nasal culture.

ber containing some polymorphonuclear leukocytes was produced in a rabbit's eye after the intravenous injection of 5.0 c.c. of a filtrate prepared from a 24-hour culture of a A. aërogenes obtained from a patient's nasal culture. A four-plus iridocyclitis was produced in five hours (fig. 3). This finding was similar to that ob-

tained with bacterial suspension of the same organism. There was marked engorgement of the vessels of the ciliary processes and iris. In certain places the endothelium was adherent to the anterior surface of the iris. There were a moderate number of polymorphonuclear leukocytes in the albuminous exudate in the anterior chamber and in the ciliary processes. Some sections showed less congestion of the ciliary processes and iris, less albuminous exudate in the anterior chamber, and no anterior synechia.

Summary and conclusions

1. Using coliform bacilli found in the upper respiratory tract of man, transitory acute iridocyclitis was produced in rabbits with smaller amounts of culture and in a higher proportion of animals than when other types of bacteria, ordinarily found in the same tract, were used.

2. Iridocyclitis was also produced by filtrates of these cultures. This suggests that the inflammation may be caused by a filterable factor rather than by the accumulation of bacteria within the blood vessels of the iris.

3. The iridocyclitis-producing power and toxic effects of both filtrates and cultures were found to diminish with age.

4. It was possible to produce a temporary partial or complete immunity to the coliform bacilli in rabbits by one or more intravenous injections of small doses of culture or filtrate.

5. Filtrates prepared from the iridocyclitis-producing strains of coliform bacilli produced the same intensity of iridocyclitis as did the cultures from which they were prepared, when injected into rabbits in similar amounts.

6. The upper-respiratory coliform bacteria used in these experiments were more lethal and produced a more severe iridocyclitis in rabbits than did miscellaneous fecal coliform strains.

7. The apparent high incidence of coliform bacteria obtained from the upper respiratory tract of patients with eye diseases, and the ability of these strains to produce acute iridocyclitis in rabbits, seem to warrant further study of the possible role played by these organisms in the etiology of eye diseases, supposedly caused by focal infection.

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We are grateful to Mr. George H. Chapman for his assistance in the preparation of this report and to Dr. Eugene L. Opie, Dr. D. Murray Angevine, and Dr. Sidney Rothbard for their helpful suggestions.

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Discussion

Dr. H. M. Langdon, Philadelphia, Pennsylvania: I should like to ask Dr. Berens just one question: whether the inflammatory conditions in the eye were limited entirely to the iris, or whether they involved any of the deeper structures, and also whether any other structures of the body were involved in the inflammatory process.

Dr. Conrad Berens, closing: I wish to thank Dr. Langdon for asking this important question. There seems to be little involvement of the other structures of the eye. In some cases we did see some involvement of the choroid, but the main lesion was acute iridocyclitis. This led to the paper, which some of you may have seen (Jour. Exper. Med. 1940, v. 71, Feb. 1, p. 129), from the Department of Pathology of Cornell University Medical School, on the relation of the structure of the villi of the joints to the ciliary processes, because one of our primary interests has been the relation of chronic arthritis to inflammatory eye lesions.

As to the question of the other organs of the body being involved, they may be affected somewhat by the inflammatory process, as one would expect with so highly toxic an organism.

KERATITIS DUE TO MUMPS

RALPH W. DANIELSON, M.D., AND JOHN C. LONG, M.D.
Denver, Colorado

Various types of eye complications have been found associated with epidemic parotitis. Among the conditions described are dacryoadenitis, conjunctivitis, scleritis, keratitis, uveitis, retrobulbar neuritis, neuroretinitis, and ocular palsies. Reviews of the reported ocular involvements have been made by Sendral,[1] Woodward,[2] Villard,[3] and Bonnet.[4]

Keratitis is one of the rare complications of mumps. We having been able to find the description of but seven cases. Woodward noted the condition only once in 134 cases of ocular involvement of epidemic parotitis collected from the literature. Keratitis accompanying mumps has been reported by Brejski,[5] Charles,[6] Worthington,[7] Lundsgaard,[8, 9] Geis,[10] and Detroy.[11] In the reported cases, the onset, appearance, and course are sufficiently uniform for us to consider this condition a definite entity. The corneal disturbance begins within 2 to 11 days after the onset of the parotid swelling, with redness and lacrimation, but with little pain. Within a few days the cornea becomes very cloudy, and there is marked reduction in vision. The pupil will dilate maximally with atropine, and synechiae have not been observed. Corneal vascularization does not occur, and complete recovery with unimpaired vision takes place in from one to four weeks. All of the cases described have been unilateral. Table 1 gives a synopsis of cases reported by the authors mentioned herein.

In view of the rarity of the condition and the close correspondence with the previously reported cases, we believe that the following personal observation should be placed on record.

TABLE 1

KERATITIS DUE TO MUMPS REPORTED IN THE LITERATURE

Sex	Age	Eye	Onset After Mumps	Vision at Height	Duration	Final Vision	Degree of Recovery	Observer
F	40	L	7 days	Fingers	16 days	?	almost complete	Brejski
M	28	R	2 days	8/240	30 days	15/12	slight nebula	Charles
M	23	R	8 days	Fingers	7 days	20/20	complete	Worthington
M	37	L	11 days	Fingers	12 days	20/20	complete	Lundsgaard
F	12	L	7 days	?	30 days	20/20	complete	Lundsgaard
F	10	L	6 days	?	7 days	?	complete	Geis
F	46	R	coincident	Light	19 days	20/20	complete	Detroy

CASE REPORT

R. E., a Spanish-American boy of 9 years, was brought to us on December 15, 1939, because of defective vision and abnormal appearance of the right eye. The boy had developed bilateral parotid swelling on about December 4, 1939, during a school epidemic of mumps. Two brothers and one sister also had mumps at approximately the same time. All of the attacks were mild. On December 7, 1939, the right eye of our patient became red and somewhat tender. Three days later the parents noticed that the lower portion of the cornea was cloudy. The corneal cloudiness increased, reaching a maxi-

mum on about December 14, 1939. There were some photophobia and tearing, but pain was present for two days only. Our examination on December 15, 1939, showed a moderate degree of circumcorneal injection. The cornea was diffusely and rather uniformly grayish-white. The epithelium was intact and did not stain with fluorescein. Slitlamp examination of the cornea showed very numerous white interlacing fibrillae in the thickened substantia, but no vascularization. No deposits were observed on the posterior surface, but this could not be critically examined. There was some striate wrinkling of Descemet's membrane. The pupils dilated maximally with atropine and there were no synechiae. The corneal haze prevented an examination of the fundus. The tension was normal. Vision was reduced to the perception of hand movements. The left eye was entirely normal with vision of 20/20.

A complete pediatric examination was done at the University of Colorado Out-Patient Department, with essentially negative findings. The blood Wassermann and Eagle tests were negative. No stigmata of congenital syphilis were found.

Dramatic improvement in the cornea was obvious from day to day. On December 17, 1939, the vision had improved to 3/60 and by December 19, 1939, the vision was 20/50, and a good view of the normal fundus could be obtained. By December 19th, the only remains of the keratitis consisted of a slight haze in the central portion of the cornea and some striate wrinkling of Descemet's membrane. At no time did we find cells in the aqueous or deposits on the corneal epithelium, although these might have been overlooked at the height of the keratitis because of the cloudiness of the cornea. The patient left the city on December 19, 1939, and we had no opportunity to observe him further, but we learned through correspondence that the eye returned to normal, probably in about two weeks and that the eventual vision was as good as in the other eye.

Conclusions

Descriptions of seven cases of keratitis following mumps have been found in the literature, and one new case has been observed by the writers. There is sufficient similarity in the onset, course, and appearance of these cases to justify considering this condition as a definite clinical entity. The disease affects one eye only, and begins from 2 to 11 days after the onset of the parotid swelling. The cornea is rather uniformly grayish-white with very minute white interlacing fibrillae. Pain is not severe, but photophobia and lacrimation are present. Vision is markedly reduced. Improvement occurs with astonishing rapidity, resulting in complete recovery within a month or less after onset. There is no vascularization nor scarring of the cornea. The uvea is apparently not involved in the inflammatory process.

324 Metropolitan Building.

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LATE DEVELOPMENTS IN A CASE OF GYRATE ATROPHY OF THE CHOROID AND RETINA (FUCHS)*

HUNTER H. MCGUIRE, M.D., AND (BY INVITATION) WILLIAM P. MCGUIRE, M.D.
Winchester, Virginia

In 1932, before the Section on Opthalmology of the American Medical Association, one of us (H. H. McG.[1]) reported a case of gyrate atrophy of the choroid and retina as originally described by Fuchs at the Heidelberg Congress in 1895. The present article deals with the further progress of the condition in the same patient. In the original report of this case the changes in the fundi were of an early type, and the view was expressed that the degenerative process could possibly be regarded as stationary, but that it was also possible that later changes would ensue which would show involvement of the as yet uninvaded central and peripapillary zones in the fundus. The present report is published because, from a review of the available literature, we have been unable to find any case in which both the early and the late changes have been reported.

CASE REPORT

L. A. T., a white male, aged 11 years, was referred to one of us (H. H. McG.) through the courtesy of Dr. Henry L. Sloan, of Charlotte, North Carolina, in June, 1930. At that time the patient had been under the care of Dr. Sloan for 18 months, and in January, 1930, had been seen in consultation by Dr. de Schweinitz. When first seen by Dr. Sloan, the vision, with a myopic correction, was 20/20 in each eye, and subsequent examinations revealed a slowly progressive myopia with a constant, but slow, reduction in visual acuity, and a peripheral retinitis in both eyes (fig. 1). The boy had undergone thorough physical and laboratory examinations with negative results. He had had most of the usual diseases of childhood without sequelae. The family history was entirely noncontributory, the parents being healthy, not related, and having no ocular disturbance. Two sisters were living and well and had no ocular defects.

In June, 1930, after repeated examinations, both with and without cycloplegics, the following correction was obtained: O.D.: -1.75 D.sph. $\bigcirc\!\!\!

ness were negative, and there had been no complaint of nyctalopia.

The external examination and the slit-lamp findings were entirely negative in each eye. Muscle-balance tests showed a comitant right hyperphoria of 2 prism-diopters for both distance and near. The media throughout each eye were entirely clear. At this time (1930) the discs had sharply defined margins, and showed no alterations in size, shape, or color. The retinal and choroidal vessels were devoid of pathologic changes. In the mid-zone of both eye-grounds were numerous fine granular changes somewhat analogous to the condition described as miliary chor-

Fig. 1 (McGuire, H. H., and W. P.). Section of the affected zone in the early stages of the case of gyrate atrophy of choroid and retina.

oiditis, and in the extreme periphery there was a broad zone of irregularly shaped choroidal atrophies forming a complete circle and separated by normal, though deeply pigmented, fundus tissue. The atrophic areas varied greatly in size, shape,

and distribution. In some instances they appeared as small, round, isolated islands and again as large, irregular areas almost in apposition, but separated by thin lines of pigmented tissue. Both choroidal and retinal vessels coursed over the exposed sclera in the atrophied areas, and in these clumps of pigment had been deposited on the white fields, which differed in appearance from those usually observed in retinitis pigmentosa. At this time the central and peripapillary zones showed no evidences of atrophy.

From the time of the first examination, in June, 1930, this patient was seen at intervals of six months until the early part of 1936. During this period there was a slowly progressive myopia, with slight loss of visual acuity, so that by February, 1936, refractive error under cycloplegia was: O.D.: −3.50 D.sph. ⌯ −1.25 D.cyl. ax. 15° = 20/30; O.S.: −3.50 D.sph. ⌯ −1.50 D.cyl. ax. 180° = 20/40−. During this time the patient was pursuing the normal scholastic activity of a boy in high school without ocular symptoms or discomfort and with no signs of night blindness. At these periodic examinations it was seen that there was a slight increase in the mottling in the central areas of the fundus of each eye, with a questionable thinning of the choroid in these regions (fig 2). The appearance of the discs and retinal vessels remained unchanged, and there was no further contraction of the fields. A small

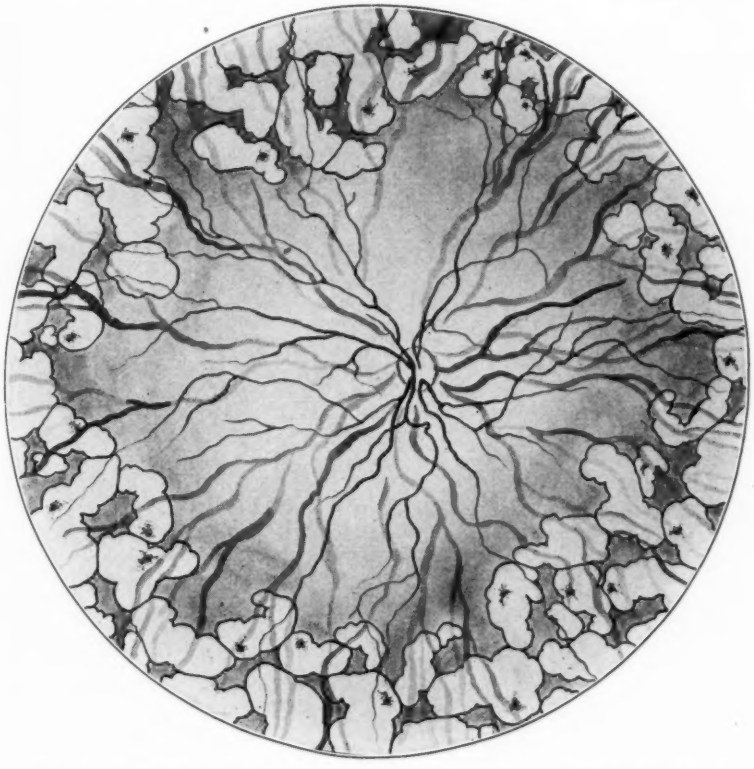

Fig. 2 (McGuire, H. H., and W. P.). Diagrammatic sketch, showing distribution and fantastic shapes of the atrophic areas in the early stages of the case of gyrate atrophy of the choroid and retina.

central posterior subcapsular opacity was first observed in the left lens in July, 1935.

After February, 1936, the patient moved to North Carolina, and was again under the observation of Dr. Sloan. While there, he entered college, and in June, 1940, is to be graduated, with a good standing in his class. Fields taken by Dr. Sloan in July, 1939, showed, in the right eye, a contraction of the peripheral field, with a partial ring scotoma and enlargement of the blind spot, whereas in the left eye the peripheral contraction was more marked, and the ring scotoma was almost complete, with the exception of a very small crescentic area of vision in the lower temporal portion of the scotoma. Vision in each eye was 8/200 without correction, and with −4.00 D.sph. ⊂⊃ −1.00 D.cyl. ax. 180° in each eye his vision was 20/50+ in the right eye and 20/50− in the left eye.

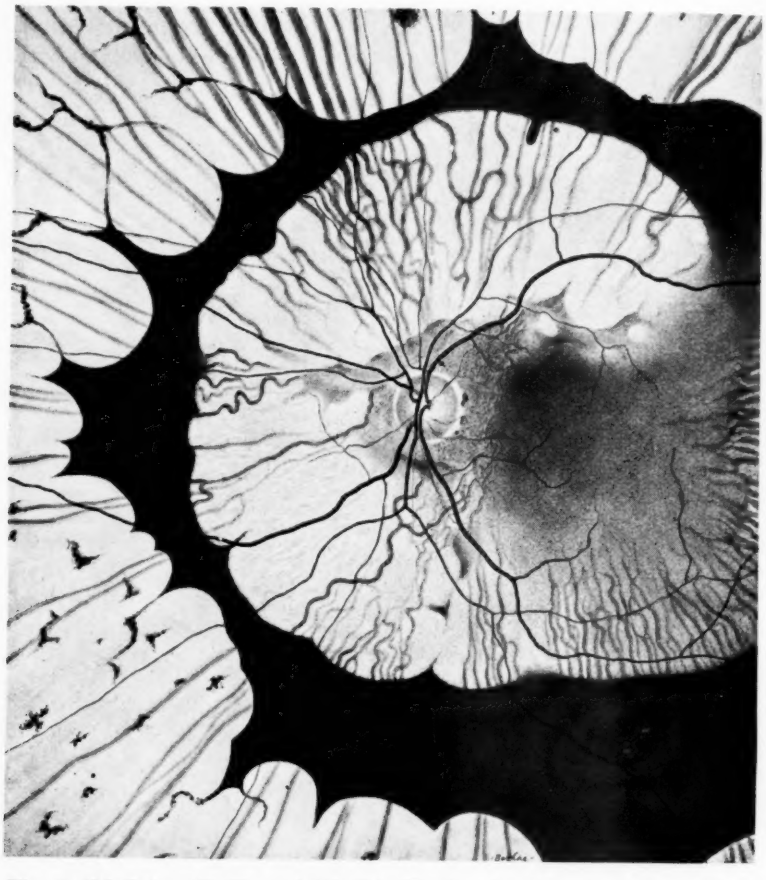

Fig. 3 (McGuire, H. H., and W. P.). Fundus drawing showing advanced stages of the case.

The patient was next seen by us on October 25, 1939, and at this time an additional fundus drawing was made (fig. 3). At this visit he reported that during the past three years he had noticed an increasing difficulty in seeing in the dark, so much so recently that he was forced to carry an electric flashlight with him whenever he ventured out at night.

The fields showed a marked concentric contraction with a ring scotoma in each eye, the central visual area being only about 10 degrees in diameter (fig. 4). The fundus changes were much more pronounced than when his case was first reported in 1932. The areas of choroidal atrophy, which originally had been confined to the periphery of the fundus in each eye, had extended inward. In each macular region there appeared to be almost normal retinal and choroidal tissue, but these areas had also undergone some changes in that there were numerous fine granular pigment deposits in each posterior pole. Between the zone of peripheral atrophy and the discs there was a narrow ring-shaped area of fundus that was almost normal in appearance, except that here, too, there was a fine granular pigmentation. Surrounding the disc in each eye there was a large area of choroidal and retinal atrophy and some choroidal sclerosis was present. In the areas of atrophy, both peripherally and centrally, there were scattered pigment deposits of irregular shape, and in the central areas these were quite large. The nerve heads themselves were of good color and well outlined, and, except for the few isolated areas of choroidal sclerosis, the choroidal and retinal vasculature presented a normal appearance. The vitreous in each eye contained many small and medium-sized opacities which, by their rate of movement, indicated that this substance was more fluid than was normal. In each eye there was a posterior polar cataract, but no additional lenticular changes. Manifest refraction at this time gave the following result: O.D.: -3.75 D.sph. $\backsimeq -1.25$ D.cyl. ax. $10° = 20/40+$; O.S.: -4.00 D.sph. $\backsimeq -1.00$ D.cyl. ax. $165° = 20/70+$.

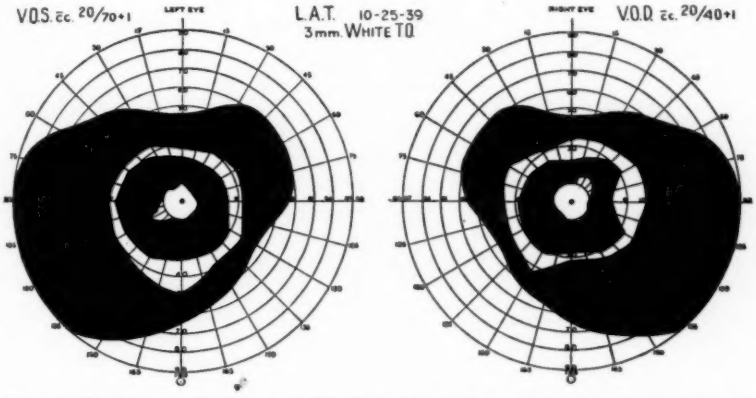

Fig. 4 (McGuire, H. H., and W. P.). Field changes in the late stages of the degenerative process.

Until the report of this case in 1932, comparatively few references to the subject under discussion were found in the literature. Fuchs's[2] four clinical histories, three of which were reported by Cutler[3] and one by himself, were fully described in the original paper, and references were made to the case reports by Jacobsohn,[4] Komoto,[5] and Bednarski.[6] It should be emphasized, however, that three of Fuchs's cases occurred in sisters whose ages were, respectively, 21, 24, and 26 years. The parents were first cousins. Their symptoms in common were night blindness, posterior polar cataract, and a peculiar form of choroidal atrophy at the periphery bounded toward the disc by a lobulated

margin of normal fundus. Two of the sisters showed high myopia, with marked reduction of visual acuity, whereas in the case of the other sister the refractive error is not recorded and the vision was reduced to light perception.

In his discussion of the paper before the American Medical Association presented in 1932,[1] Holloway refers to certain other probably allied conditions, such as retinitis pigmentosa, retinitis pigmentosa sine pigmento, retinitis punctata albescens, congenital night blindness, and choroideremia, and observes that one might with propriety refer to the whole group as retinal degeneration, using a qualifying term to indicate the type. This fact, however, and the presence of certain clinical appearances in the fundus, do not necessarily mean that the underlying pathologic process is the same.

Holloway called attention to the fact that in the gyrate type the condition is not sex limited and is usually seen in the second and third decades, the youngest patient (the present case) recorded being 11 years, and the oldest, aged 29 years (Fuchs). He likewise pointed out that consanguinity may or may not be present, and that night blindness was present in all cases except in the one described in the present report.

In a further discussion of the case reported by Wernicke, who expressed the opinion that the degenerative changes first seen in the periphery are followed by invasion of the central zones, and finally by a stage in which practically all the normal fundus structures disappear (choroideremia), Holloway concluded that our case was the earliest manifestation of this condition on record, and is the first to be included in Wernicke's first stage.

Since the original report of this case in 1932 we have been able to find in the literature records of only five additional cases. The first of these was reported by Lyle[7] in 1932, his patient being a youth aged 12 years. In this case the fundi showed the typical picture of gyrate atrophy of the choroid and retina. An interesting feature was that the patient was totally blind at night, but could see well enough to get about quite easily during the day. Nyctalopia was first noted at about four years of age. This contrasts sharply with our case, in which night blindness was a relatively late development. In addition, in Lyle's case, there was a history of consanguinity, and of a sister of the patient who had similar, although not so marked, changes in the fundi.

Werkle,[8] late in 1931, reported three generations of a family of 33 in whom 13 suffered from nyctalopia. Of these, two brothers, aged 10 and 20 years respectively, showed terminal stages of gyrate atrophy of the choroid and retina, but the remainder of the family did not present the characteristic picture of the condition. In addition, Werkle reported the case of another patient, a man aged 50 years, not related to the same family, who also showed a terminal stage of gyrate atrophy of the choroid and retina.

Bietti,[9] in 1937, in discussing rare forms of retinal degeneration, reported one case of advanced gyrate atrophy of the choroid and retina, and Duke-Elder,[10] in a personal communication during the past year, reports having recently observed such a case.

Hepburn,[11] in an address on the nomenclature of diseases of the fundus, delivered before the Royal Society of Medicine in 1939, deplores the inaccurate nomenclature of diseases of the fundus, and stresses the fact that in gyrate atrophy the subjects are most commonly young persons who suffer from night blindness in addition to defective central vision, whereas in sclerosis of the choroidal vessels at the macula, a condition which

has at times been confused with gyrate atrophy, the subjects are elderly persons whose central vision is considerably below normal, but who see better in dull light.

Conclusions

The case is reported again because of the unusual opportunity presented to study, over a period of 10 years, the slowly developing fundus changes, and for the purpose of exhibiting comparative illustrations of the early and late stages of the degenerative process.

Subsequent observations have served to refute the opinion, expressed in the original paper, that the disease may be regarded as stationary.

Night blindness, a symptom conspicuous by its absence in the early stages of the degeneration, is now definitely present.

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Discussion

Dr. John Green, Saint Louis: I should like to ask Dr. McGuire whether general therapy had any effect on this process.

Dr. W. P. McGuire, closing: I wish to thank Dr. Green for his question. I should have mentioned this. No therapy that we have tried, or that has been tried by other physicians, has had any effect on this condition. The last time we saw the patient, in October, we put him on a very high vitamin diet. We have not seen him since then, and do not know whether it had any effect on the disease. I am somewhat doubtful whether it would have.

PSAMMOMA OF THE ORBIT*

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Psammomatous orbital tumors, usually in the retrobulbar portion of the orbit or near the upper inner angle of the orbit, have been reported. Such psammomatous retrobulbar tumors have either had origin in the sheaths of the optic nerves, or have extended into the orbit from the cranial cavity. Psammomatous tumors situated in the upper or the upper inner angle of the orbit have been associated with changes in the frontal or frontal and ethmoidal sinuses. The present case report is that of a tumor of the latter type.

Case report

H. C., male, white, aged 32 years, was admitted to the service of Dr. Griscom at the Wills Hospital, February 26, 1940. The patient stated that in 1933 he had an acute localized infection of Tenon's capsule on the temporal side of the right eye. The infected area was incised and healed satisfactorily. There was a recurrence of the condition in April, 1935. It was again incised, with subsidence of the symptoms. Apparently a similar condition recurred in 1937, and the swelling persisted, without pain or tenderness, until the patient's present admission to the hospital. There was exophthalmos, the eye being pushed down and out. Vision has been blurred for three years, and he had diplopia when looking up and to the right. The swelling and exophthalmos have remained constant for the past three years.

Ophthalmic examination. Intraocular tension of both eyes was normal. Right eye: There was marked swelling of the upper lid, measuring about 2 by 3 cm. It was firm, and the skin moved freely over it. The growth was firmly attached to the upper and outer rim of the orbit. The upper rim of the orbit was rough and uneven. There was no tenderness. The cornea was 13 mm. below that of the left eye, and the globe was exophthalmic. Limitation of motion was confined to the upper and the upper outer quadrants. There was diplopia in the upper and right fields.

The anterior segment of the globe appeared normal except for slight conjunctival injection.

In the fundus of the right eye there was a flat detachment, involving the temporal half of the retina. No tears were seen. Except for slight blurring of temporal margin, the disc was normal. The retinal vessels also appeared normal. Vision was 6/60.

The examination of the left eye and orbit showed it to be normal in all respects. The vision was 6/6.

Nasal examination. Made by Dr. J. Reese. There was no evidence of purulent sinus disease. There was a slight manifestation of catarrhal exudate in the right nostril, and some inflammatory reaction of the nasal mucosa in both nostrils, but more marked on the right than on the left side. The laboratory examinations were essentially negative. The spinal fluid, Wassermann, and Meinicke reactions were also negative.

X-ray examination. By Dr. E. W. Spackman. In the right frontal sinus was a shadow in the inferior one half which spread from approximately 1 cm. left of the crista galli to over and along the right supraorbital ridge, involving the roof of

* From the Department of Pathology of the Wills Hospital. Read before the American Ophthalmological Society, Hot Springs, Virgina, June, 1940.

the orbit for approximately three fourths of the length and the inner lower one third of the frontal sinus. The evidence of invasion was apparently through inner and outer plates, but the plates show no evidence of destruction in the lateral projection, and the sinus appeared to be clear. Outlines of the entire right cell were irregular, but smooth and thickened.

The *ethmoid sinus* on the right side was slightly hazy when compared with the left.

The right *maxillary sinus* was clouded in the lateral two thirds, but outlines were reasonably sharp.

The *sphenoidal sinus* was negative, and the *sella turcica* was normal.

Operation on March 12, 1940, by Dr. J. D. Reese. Through an incision for a

Fig. 1 (Fry and DeLong). Exophthalmos of the right eye, with a tumor mass above and fixed to the orbital margin.

radical frontal-sinus operation the cystic neoplasm was removed from the orbit and frontal sinus. The orbital plate of the frontal sinus had been partially destroyed. The roof of the frontal sinus was intact.

Pathologic examination. The tumor mass was about the size of a walnut. It was fairly well circumscribed, and was enveloped in a thick fibrous capsule.

Microscopically, the specimen consisted of loose cellular tissue, with a tendency to whorl formation. In the center of the

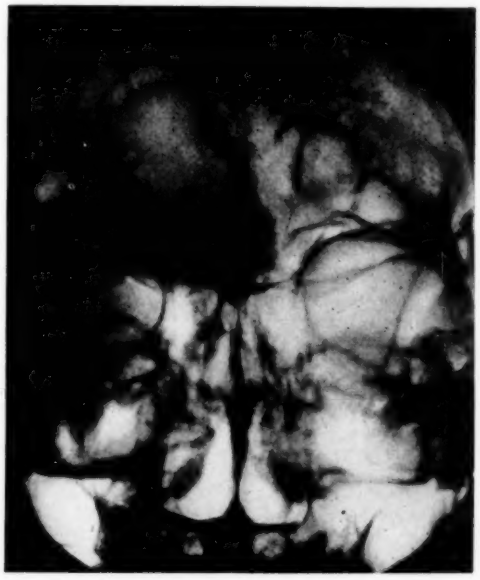

Fig. 2 (Fry and DeLong). X ray showing destruction of the right upper orbital margin and cloudiness of the right frontal sinus.

whorls there were uniformly deep bluish masses, for the most part without definite structure. The hardness of these masses caused the sections to tear in cutting. The tumor cells contained elongated or oval nuclei, some being small and staining deeply, and others being larger and staining moderately densely. Nucleoli were inconspicuous, and there was no definite chromatin network. Mitosis was not apparent. The cytoplasm was scanty. Many of the cells tapered at the ends into fine fibrillae. There were a few, empty, endothelial-lined spaces.

Diagnosis. Psammoma.

The microscopic appearance of this

tumor was similar to that of the intracranial tumors that have been designated by many authors dural endotheliomata. Numerous names have been applied to these growths. Virchow termed this tumor psammoma. Other names applied were: endothelioma, by Golgi; arachnoid fibroblastoma, by Mallory; meningoblastoma, by Oberling; meningeal fibroblastoma, by Penfield; and neuroepithelioma, by Roussy and Cornil. Cushing[1] applied the name meningioma to the growth, and Globus[2] prefers the same designation. Both Cushing and Globus subdivided meningiomas into several types.

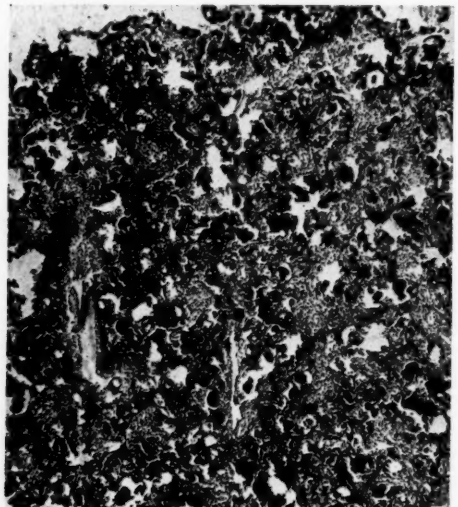

Fig. 3 (Fry and DeLong). Photomicrograph. Note the psammoma bodies and the cellular structure (× 37).

The psammoma bodies represent areas that have undergone degeneration, hyalinization, and calcification. In the opinion of Globus, these bodies represent vascular buds that end blindly, blocking the circulation of the enclosed blood. As a result, this contained blood, as well as the enclosing vascular wall, undergoes degeneration, hyalinization, and calcification. Psammoma bodies are found normally in the pineal body. They have also been reported in tumors of the skin and of nerve sheaths.

A number of cases of meningioma of the sheath of the optic nerve have been reported, and some of these contain psammoma bodies. In Lundberg's[3] series of cases in the literature from the time of Hudson's report in 1912 to 1935 there were 29 cases diagnosed as endothelioma of the sheath of the optic nerve. Of these, five were diagnosed psammoma endotheliomas and five as psammomas.

Some question has arisen as to whether such tumors were primary in the orbital portion of the optic nerve or were primary in the cranium and extended into the sheath of the optic nerve. Verhoeff[4] has expressed the opinion that they were all primarily intracranial. Cushing believed that the point concerning their

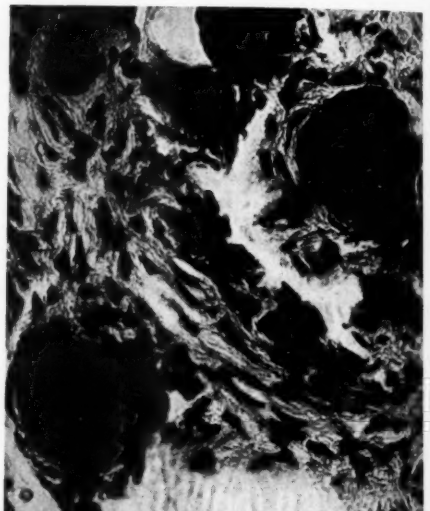

Fig. 4 (Fry and DeLong). Microphotograph. Note the tendency to whorl formation about the psammoma bodies (× 500).

origin is definitely settled, and that some of the tumors are primary within the orbit. He based his opinion on the examination of the microscopic sections of a case sent him by Dr. Jonas Friedenwald, in which the proximal part of the optic nerve adjacent to the foramen showed normal nerve and nerve sheath.

It is difficult to determine whether the psammomatous tumors of the orbit that are unconnected with the sheath of optic nerves have their origin within the orbit.

Goodyear[5] has reported a case in which the sinuses were involved eight months after removal of an intracranial tumor from the left frontal area. The growth had extended through the dura in the region of the cribiform plate. In this case the sinus was probably involved by extension from the intracranial tumor.

Eickens[6] reports a case in which a psammomatous tumor was removed from the frontal sinus. Exophthalmos was present which Eickens believed was due to outward displacement of the lamina papyracea, without extension through the wall into the orbit. He expresses the opinion that the tumor may have had its origin from the sheath of the optic nerve near the sphenoid.

Wiegman[7] reported a case in a patient, aged 16 years, in whom a tumor occurred in the upper inner angle of the right orbit. It was separated from the orbital margin, had been present for two years, causing an exophthalmos of 10 mm. The tumor was removed, but six months later an ethmoid abscess occurred. This writer believed that the sinus was secondarily involved.

Levkoeva[8] reports three cases, similar to the one of Wiegman just described. One was in a 12-year-old boy in whom the origin was believed to be in the inner upper angle of the orbit, and external to the frontal and ethmoidal canals; the second was in a 30-year-old woman and the third was in a 13-year-old girl.

Parzani[9] reports a case of psammoma of the conjunctiva of the lower fornix. The tumor began as a swelling near the caruncle of the left eye, and later involved most of the lower bulbar conjunctiva. In the histological examination of the excised tissue there were found columns of cells, a slight amount of connective tissue, a moderate degree of vascularization, with concretions surrounded by whorls of cells. Parzani described the tumor as either a psammo-endothelioma or a psammo-angio-endothelioma, and believes that it might have had its origin in the endothelium of the blood vessels.

In the case described in the present paper there is reason to believe that the origin of the growth was in the orbit. The history suggests a beginning growth connected with the upper outer part of the globe. These tumors are slow growing. The three-year history of swelling and exophthalmos does not seem out of keeping with the view that the tumor originated in the orbit at that time. The second possibility is that the tumor growth had its origin in the frontal sinus, a possibility that cannot be entirely ruled out in this case. A clean-cut case for non-sinus origin would require the presence of a small tumor removed before there was sinus involvement. It does not seem probable that the growth under discussion had its origin in an intracranial meningioma that extended into the frontal sinus and from there spread into the orbit. At operation no dura was exposed, and the X ray revealed a normal inner wall of the frontal sinus. That it had its origin within the orbit seems to be the reasonable conclusion.*

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* We are able to report this case through the courtesy of Dr. J. Milton Griscom.

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A RARE FORM OF GLAUCOMA*

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Reports of glaucoma following mydriasis are scarce. A recent summary[1] lists but one case reported since 1916, when the late H. Gifford[2] published his exhaustive compilation. This summary accepts Gifford's estimate of one occurrence in 10,000 such examinations. Any danger from the procedure is usually obviated, as he showed, when miosis is employed promptly. Less convincing, however, are the recent intimations that the risk can be virtually ignored in patients under the age of 30 years, and that the occurrence should be regarded as an aid in unmasking a glaucomatous predisposition.

Of the following cases, a few were not seen by the writers during the attack. This accounts for the difficulty of obtaining complete data. For this reason the validity of cases 1 and 3 is vulnerable, although the interpretation here given is the probable one. The first four patients were included by Beach in an unpublished report at the 1932 reunion of the ophthalmologic house officers of the Massachusetts Eye and Ear Infirmary.

* Read at the American Ophthalmological Society, at Hot Springs, Virginia, June 4, 1940.

Case Histories

Case 1. A woman of 40 years, when advised refraction under cycloplegia, declined, alleging that 10 years previously she had had an attack of intolerable pain in her eyes following such an examination. Distrusting her original examiner, she had immediately sought relief from another oculist who sent her to the hospital, where she remained for several days. She was told that her eyes were hard. When seen by Beach, tension, nerve head, vision, and fields in both eyes were normal.

Case 2. A woman, 29 years of age, was examined under homatropine on March 22, 1924, at the clinic of the Maine Eye and Ear Infirmary. The test showed high hyperopic astigmatism. She gave a history of empyema of the sphenoid sinus. The day following the examination she reported that six hours after the examination she had an attack of pain in the right eye. Investigation revealed a hard globe, moderate circumcorneal injection, steamy cornea, and a partly dilated pupil. Except for a small cyst of the iris, the unaffected left eye was normal to touch and in ap-

pearance, but the pupil was still completely dilated. Under instillations of pilocarpine, 1 percent, and eserine, 0.5 percent, at 10-minute intervals, the pain subsided in one hour. The following day the appearance was normal, except for a possible shallowness of the anterior chambers. Vision was the same as before the attack. Tension was 20 mm. Hg in both eyes (old Schiötz scale); Bjerrum's and Rönne's signs were absent, and there were no field changes except slight contraction for red. This patient was seen eight years later, in 1932, at the Massachusetts Eye and Ear Infirmary. There was no history of further attacks, and examination revealed no indications of glaucoma.

Case 3. A woman reported that in 1927, at the age of 19 years, mydriasis had been followed by inflammation and impairment of the vision of the left eye. There was a record, two years before, of normal vision (corrected) in both eyes. She had not consulted a physician for the attack. Four years later, in 1931, she had corrected vision, right 6/5, left 6/9. Finger tension and confrontation fields were normal. Both eyes showed a paracentral cup occupying less than half the disc. She did not return for more thorough examination.

Case 4. In June, 1932, a woman, aged 70 years, came complaining of visual disturbance, and described an attack in England following mydriasis two years previously. As she was then being tested for glasses, she erroneously assumed that the drops had been used for this purpose. The attack occurred 24 hours after the examination, and was accompanied by nausea and fluid bowel movements; the condition was relieved in a few hours by fullstrength eserine every 15 minutes, prescribed by another physician. She believed that the pain had been equal in both eyes but "the doctor called the right eye the one." She had been seen previously by Dr. Paul Chandler and Dr. J. Herbert Waite, who kindly furnished the earlier history. For two years preceding the attack in 1930, nothing remarkable occurred. On her return after the attack the tension was 19 right, 20 left (new Schiötz). There was no cupping nor field change. For two years, under miotics, her tension varied from 13 to 21.

In June, 1932, Beach found her tension increased to 28 in each eye. The anterior chamber was shallow and the nerve showed a pale central cup one quarter the diameter of the disc. One-half percent eserine pulled the pupils down in 30 minutes, reducing the tension to 20 right and 18 left.

On November 22, 1934, after a prolonged period of mental stress, Waite found the pupil of the right eye semidilated, with a tension of 35. The pupil of the left eye remained small, tension of 19 mm. Hg. On November 26, 1934, a 2-mm. Elliot trephining furnished an excellent filtering cicatrix, maintaining a tension of 8 to 12 mm. Hg for the next year. Refraction on May 3, 1935, was as follows: O.D. +3.00 D.sph. ⊂⊃ +2.00 D.cyl. ax. 165° = 20/20; O.S. +4.75 D.sph. ⊂⊃ +1.00 D.cyl. ax. 180° = 20/20.

The discs were still entirely normal, and on that date both fields were normally full. The Schiötz readings then were: right = 8, left = 16. The left eye had been kept continuously under pilocarpine, in spite of a little follicular conjunctivitis.

Case 5. This patient was seen by Dr. Victor Ray, Jr., who courteously furnished this history: A woman, aged 42 years, complained of severe frontal headaches occurring two or three times a week. They usually came on in the latter part of the day, and were aggravated by the use of her eyes for close work. External examination showed that her eyes

were normal, pupils equal, reacting to light and accommodation. Ocular tension was normal to palpation, and peripheral form fields were normal to hand tests. Refraction under homatropine showed hyperopia of plus 3.00 each eye, with a corrected vision of 20/20 in each eye. Examination of the fundi showed them to be normal except for an arterial pulsation in each eye.

The patient was confused and left the office without following instructions to have pilocarpine instilled. The next morning she returned, complaining of intense frontal headache, nausea, and reduced vision. Examination showed each eye undergoing an acute attack of glaucoma. The vision was reduced in the right eye to 20/200, in the left to 20/100—.

A solution of 0.25-percent eserine salicylate was instilled in each eye about every five minutes over a period of an hour. By this time the patient was greatly relieved of her symptoms. The pupils, which had been widely dilated, were down to 2 mm.; the transparency of each cornea seemed nearly normal, and the tension to palpation was definitely reduced.

Eserine every two hours was prescribed. On the following morning she returned, entirely relieved. Her vision was: R.E. 20/30; L.E. 20/20. The pupils were 1 mm. in diameter and no pulsation of the retinal arteries could be seen.

One week after the attack the patient showed a near point of accommodation of nine inches with correction. The blind spots were normal in dimension, and there was no evidence of Seidel's sign. The peripheral fields were normal, and the tension (McLean) was 25 mm. Hg in both eyes.

After nine months this patient was maintaining this satisfactory condition with the use of 1-percent solution of pilocarpine. It is of interest to note that the only sign that might have given any advance warning of threatened glaucoma was that of arterial pulsation.

The following records, not previously reported, were furnished by Holt:

Case 6. In January, 1919, after the instillation of eight drops of atropine sulphate, 1 percent, a youth, aged 19 years, complained of rather severe pain in each eye and in his forehead. The drops had been prescribed by a colleague and were to be used three times a day for three days prior to refraction. Examination showed marked photophobia and blepharospasm, intraocular pressure—right, 50; left, 55 (old Schiötz)—pupils well dilated, cornea steamy (edema); no clear view of the fundi. Pilocarpine, 2 percent, and eserine, one-half percent, with hot fomentations, were employed every two hours for 48 hours. As the intraocular pressure was not lowered to normal at this time, an iridectomy on each eye was performed. After recovery, vision corrected to 20/30+ in the right eye and 20/40 in the left eye. The refractive error was a high degree of compound hyperopic astigmatism. The intraocular pressure was 16. There was a slight cupping and pallor in the outer side of each disc. Peripheral fields showed a slight nasal indentation in each eye, but no central changes. Since then examination has been made annually, and the only changes were those incident to time.

Case 7. A woman, aged 36 years, in May, 1926, was given homatropine for refraction at the clinic of the Maine Eye and Ear Infirmary. Four hours later pain developed in each eye. The tension was: R.E. 38; L.E. 40 (old Schiötz), with some corneal edema and pupils well dilated. The fundus was seen rather indistinctly, and showed venous congestion. Under pilocarpine, 2 percent, every two hours for 24 hours the eyes returned to normal and the tension was 18. Vision was 20/20 with no field changes. The pupils were

small and inactive, and the anterior chambers were shallow. Treatment was discontinued. Subsequently the pupils returned to normal size and were somewhat sluggish in reaction. The anterior chamber was shallow. There were no field changes, and the tension remained the same, 18. Since then several examinations have been made, the last one two years ago. There was no other change except in her refraction. The slightly sluggish pupils and the shallow anterior chamber still remain.

These two cases are from the records of the late Dr. E. E. Holt, Sr.:

Case 8. A woman, aged 39 years, received homatropine, 2 percent, for refraction. About 12 hours later she developed acute pain in each eye. Next morning both eyes were hard, pupils moderately dilated, corneae somewhat cloudy. Pilocarpine, 2 percent, was used every two hours, and the following day the eyes were free from pain, the intraocular pressure was normal to palpation. Vision was 20/20— in each eye; the pupils were small and inactive; there were no field changes. The patient remembered having had difficulty after the use of drops 10 years previously, but had neglected to mention it.

Case 9. A woman, aged 33 years, had received homatropine, 2 percent, for refraction. In about eight or nine hours discomfort in the eyes developed, and later became painful. Next day tension was greatly elevated, corneae were a little steamy, and the pupils were well dilated. Pilocarpine, 2 percent, gave relief in 24 hours. Tests showed that no permanent damage had been done to the eyes by the temporary increase in the intraocular pressure. It was noted that the pupils reacted rather slowly and that the anterior chambers were shallow.

Comment

These cases present interesting points.

1. The overwhelming preponderance of women that has always been noted still holds, with no obvious explanation.

2. Contrary to what we have been led to expect, no patient in whom refraction was the object of the mydriasis developed glaucoma subsequently. Several cases were followed for years. Some patients were given preventive measures.

3. One patient did not return to her original examiner. Another did not consult a physician. Such cases suggest that the apparent rarity of these complications may be partly fictitious. Whether patients ignore the disease or consult someone else, the examiner responsible is quite unaware of the occurrence. Thus he may never learn of its development.

4. Fortunately, in these cases, little or no damage resulted. While this is the rule, earlier reports, however, record serious results in exceptional instances. This possibility and the likelihood that cases may occur without being observed should discourage any feeling that "fear of this form of glaucoma is greater than the

TABLE OF IMPORTANT FEATURES

Case No.	Sex	Age	Features
1	F.	30	Did not return to original examiner.
2	F.	29	Shallow anterior chambers. No recurrence in eight years.
3	F.	19	Did not seek any medical treatment.
4	F.	70	Mistook examination for cycloplegic refraction. Shallow anterior chambers.
5	F.	42	Arterial pulsation.
6	M.	19	Only male, age 19. Atropine.
7	F.	36	Shallow anterior chamber; sluggish pupils.
8	F.	39	Second attack. Latent interval, 10 years.
9	F.	33	Shallow anterior chambers; sluggish pupils.

rarity of its occurrence justifies." It is fortunate that so few such incidents have resulted juridically. The action that inspired Gifford's paper appears to be unique. This is remarkable, since an attack of glaucoma induced in an unsuspecting individual who is merely getting new lenses might not be accepted as passively as one following a provocative test in which the patient is under observation and prepared for interference if needed.

5. It is evident from the advanced age of the patient in case 4, that the drops were not used for refraction, but for examination of the eye. Nevertheless she believed that glasses had been prescribed with the aid of drops. The purpose of including her record is to show how such a misapprehension throws undeserved disrepute on cycloplegic refraction. Oculists should be careful to make the purpose clear when using mydriasis for examination for disease.

6. It is seen that miotics almost invariably terminate promptly those attacks where homatropine has been used. We see no reason, therefore, for not using them as a prophylactic down to the youngest age at which this complication has been observed; namely, 17 years.[3] At least, as Gifford suggests, those persons living at a distance and not easily reached in the event of an attack certainly are entitled to this protection. We find no report of glaucoma when miotics were so used, in spite of the fact that in conventional cycloplegia some mydriasis is apt to reassert itself after the effects of the miotics have worn off. Gifford's recommendation was to give the patient eserine to use at home until the effects of the mydriatic had disappeared.[2] According to Powell,[4] with a single administration of the homatropine combination described by Beach and McAdams at the 1937 meeting of this society, mydriasis begins to subside in four hours. Under these circumstances miotics should be still more effective. In the experience of the writers, one or two instillations have appeared to be sufficient to prevent any untoward return of mydriasis.

7. Perhaps the most significant feature of this group of reports is the recurring mention of shallowness of the anterior chamber. This would seem to us to deserve greater emphasis than it has received in the literature. It was stressed by Beach in 1932 in discussing case 2. Waite mentions it in case 4 and Holt in cases 7 and 9. Stevenson's patient in 1913 likewise showed a shallow chamber with physiological cupping. This may have been the case more often than has been reported, for a shallow chamber might not arrest attention as an increase of tension or cupping would do. The importance of the depth of the anterior chamber in relation to the effect of mydriatics upon intraocular tension was pointed out by Verhoeff in 1935, in his discussion of Gradle's paper before this society.

8. With regard to age, although the danger increases with the years, it will be seen that in this brief series of cases, one fourth of the instances in which cycloplegia was the object, occurred under the age of 20 years, and one half at 30 or under. Youth, therefore, does not afford absolute security.

Conclusions

First: Apparently glaucoma following the use of mydriatics is an exceedingly rare phenomenon. Statistics, however, are unreliable, since, as in other forms of glaucoma, patients may not consult a physician. The attitude of the laity endows it with importance out of proportion to its frequency.

Second: It is not necessarily a forerunner of glaucoma. Although it is true that the younger the patient, the less liable is he to develop this disturbance, youth

down to 17 years does not confer immunity, nor does previous uneventful mydriasis render him immune.

Third: Inasmuch as these cases have, as a rule, yielded to strong miotics, we find in them no contraindication to the customary careful use of mydriatics. As a precaution the accepted practice of using miotics following mydriasis seems prudent after the age of 16 years, and certainly for patients coming from a distance.

Fourth: Presumably one reason for the scarcity of these cases is the vigilance of the ophthalmologist. These cases point out the advisability of special scrutiny of the anterior chamber and pupil before employing mydriatics.

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Discussion

Dr. John Green, St. Louis, Missouri: The case which I have to report was not a case for refraction. An elderly lady developed a unilateral acute glaucoma, and for one week was enthusiastically treated with atropine by her physician. When she came to me she had only light perception and very high tension. A prompt basal iridectomy reduced the intraocular tension, but there was no restoration of vision. Miotics were prescribed for the other eye, although she had normal tension, a full field, and fairly good vision. She did, however, have some central lens changes.

A few weeks later she returned, and, in my zeal to learn more about the intraocular situation and the periphery of the lens, I very injudiciously, as it turned out, used a drop of a 1-percent solution of suprarenin bitartrate in the unaffected eye. Within an hour the pupil had dilated and she was in severe pain. The tension went up to 50 mm. Hg (Schiötz), with a concomitant decrease in vision. I sent the patient to the hospital and spent the entire night plying her with pilocarpine, then eserine, and finally amine-glaucosan—all ineffectively. The following morning I performed a basal iridectomy, which effected a prompt and permanent reduction in tension.

From a colleague, whom she consulted later, I learned that, despite my efforts before, during, and after operation, she did not think at all kindly of me, although final vision with correction was 20/40+.

When I recommended the use of suprarenin bitartrate solution (1 percent or 2 percent), I suggested that it be used cautiously, and only in cases of chronic simple glaucoma and as an adjuvant to miotics. That warning did not deter some from using the drug in acute and chronic glaucoma, with disastrous results.

Dr. Allen Greenwood, Boston, Massachusetts: Some 30 years ago I had two women patients who, following the use of a mydriatic, developed acute glaucoma. In the first case the attack came on in the afternoon and I was called out to Cambridge from my office to relieve the patient. The other patient lived about 50 miles away from the office, and I was

called at 10 o'clock at night to relieve the patient from an attack of acute glaucoma. Both of these patients recovered.

Dr. Hans Barkan, San Francisco, California: May I ask Dr. Beach whether there are any records available regarding the time of the month in which these women developed glaucoma? Is it conceivable that when you dilate the pupil, especially in younger women who have not reached the age of the menopause, you may be doing so in a certain number of them during their menstrual period? Has it ever been ascertained whether that is a fact, and if so, would it have a bearing on whether that form of glaucoma in women of that age is a form of vasomotor instability and that in dilating the pupils you add a certain amount of local insult at the time? That may be an explanation of why it disappears of itself, or why it does not tend to become a permanent condition afterward. I would like to report one case of this kind, which occurred recently, which may throw some light on the matter. The patient was a woman, aged 48 years. She came for refraction during her menstrual period, and, having reason to believe that she might have hyperphoria, I put a patch on her eye. She came back 24 hours later. I took off the patch and found no phoria, and was on the point of saying, "That is all for today," when she turned to say goodby, and I noticed that the cornea in that eye was dull and cloudy. She had had no pain. In my consternation I said nothing, except to ask her to stay, and I put in a few drops of pilocarpine. The tension of 70 McLean dropped to normal within two or three days, and she has had no trouble since. That was a case of precipitating some angiovascular instability by the simple process of dilating her pupil for 24 hours under a patch. I would like to ask Dr. Beach if he has any records, or whether he knows of any, regarding the coincidence of the menstrual period and the development of glaucoma following the use of a mydriatic.

Dr. E. E. Holt, Jr., Portland Maine: In reply to Dr. Barkan's question, I would say that we have no record that this condition occurred during the menstrual period.

This paper stresses the possibility of increased intraocular pressure after the use of a cycloplegic, and indicates that the frequency of its occurrence is greater than 1 in 10,000 cases. Such episodes should tend to make us a little more cautious, but should not deter us from using these drugs. In over half of our cases the anterior chamber was shallow and the pupils were somewhat sluggish. These signs may be unfavorable, although they are not positive. In the case of increased intraocular pressure it seems reasonable to deduce that control may be facilitated if the methods of Beach and McAdams, as presented before this society in 1937, are used. As to the use of miotics following a cycloplegic, I have followed the suggestions of H. Gifford, as given in his paper in 1916. Eserine, one-sixth to one-fourth percent, is instilled two or three times after the examination is concluded, and the patient is observed for an hour at least. If the patient lives out of town, a weak solution of the miotic is prescribed to be used two or three times a day for three or four days.

BOECK'S SARCOID OF THE LACRIMAL GLAND*

WITH BILATERAL IRIDOCYCLITIS

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Boeck's sarcoid has only recently been recognized as a single pathologic process with disseminated manifestations. It is most familiar to dermatologists, for a majority of cases have been reported as eruptions of the skin, affecting usually the face, ears, nose, and extremities. Hunter[1] in 1936 defined the condition as fellows: "Hutchinson-Boeck's disease (generalized sarcoidosis) is a generalized systemic disease and may involve, in addition to the skin, the lymph glands, spleen, lungs, bones, conjunctiva, and parotid gland." Involvement of the lacrimal glands is extremely rare.

The most outstanding feature is involvement of the lymph nodes, and in many cases there is involvement of the mediastinal lymph nodes. Kissmeyer[2] reported 278 cases and emphasized the frequency with which the bronchial lymph nodes, the lungs, and the bones are affected. X-ray studies of the chest disclosed enlarged peribronchial lymph nodes in 19 of 24 cases, and in 15 of the 19 there were increased hilar shadows. The hilar infiltration was diffuse and dense, chiefly in the middle or lower halves of the lungs, extending from the hilum towards the periphery. Although the condition is often mistaken for tuberculosis, the shadows are not generally in the direction of the upper lobes or apices, and there are no signs or symptoms to indicate extensive disease in the lungs.

Changes in the bones are remarkable. The hands and feet are usually affected, but in rare instances the long bones of the extremities are involved. Occasionally there is no external evidence of the disease, but usually the fingers are irregularly enlarged, the tips squared, with some dorsal flexion of the last phalanx. The X-ray appearance is characteristic. There are areas of rarefaction and reticulation distributed throughout the medulla of the phalanges, sometimes with irregular enlargement and distortion of the bones, but without involvement of the periosteum or of the joints.[3]

Pathologically, Boeck's sarcoid is almost exactly that of "miliary tubercle" without a surrounding inflammatory zone. Large giant cells are seen, but there is no necrosis. The picture has been described as a "hard tubercle."

Ocular and orbital changes have been reported as an iritis, a uveitis, as conjunctival involvement, and as lacrimal-gland swellings. According to King,[4] in 10 percent of cases of Boeck's sarcoid there is iritis of the nodular type, which may be mistaken for the tuberculous. Osterberg[5] and Blegvad[6] agree that the two can be distinguished and describe Boeck's iritis as a less painful, less destructive, and less proliferative lesion. The nodules are large, rough, and irregular, and of a reddish-yellow color. They appear to be firm and are woven through by a mass of small blood vessels which may branch superficially. When they heal they leave no trace of their presence in the iris tissue. The nodules in tuberculous iritis are of a dirty-white hue, with a smooth surface. They come from the depths of the iris tissue and seem to push the iris fibers aside as they do so. The blood vessels pass over and around the nodules. When they heal they leave

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atrophic areas in the iris. The diagnosis is also aided by the patient's general condition, the tuberculin test, and roentgenogram and microscopic examinations.

Derby and Verhoeff[7] in 1917 found no report of sarcoid involvement of the eye in the ophthalmic literature and reported a case of sarcoid of the eyelid. King[4] reported seven cases of ocular Boeck's sarcoid. These included a case of keratouveitis with secondary glaucoma, in which the diagnosis was made by biopsy of a cervical node. In this case the X-ray studies of the chest were first thought to indicate tuberculosis or Hodgkin's disease, although later interpreted as Boeck's sarcoid. The second case, which simulated uveoparotitis, presented a severe uveitis with keratitis, associated with typical sarcoid changes in the skin, and swelling of the cervical, submaxillary, and axillary lymph nodes and the parotid glands. Typical X-ray changes of sarcoid were found in the phalanges and in the chest. The diagnosis was made by biopsy of a lymph node. The third case manifested a severe bilateral iridocyclitis which cleared rapidly and in which there were the usual X-ray changes. In the fourth case there was a low-grade serous iritis. The diagnosis was made by diffuse hilar shadows on X-ray examination, and at a later date was confirmed by the development of skin manifestations of sarcoid. In the fifth case a mild uveitis was found, in which X rays of the chest were interpreted as sarcoid. The sixth case presented a bilateral uveitis with bilateral enlargement of the parotid glands. The condition was first interpreted as uveoparotitis, and the X-ray studies were interpreted as manifesting tuberculous lesions. Later the X-ray studies were interpreted as showing Boeck's sarcoid. The final case reported by King was diagnosed by biopsy of an orbital mass in the lower fornix of the conjunctiva.

It is noteworthy that in two of the seven cases there were enlarged parotid glands and that the cases simulated uveoparotid fever. There was no enlargement of the lacrimal glands. The diagnosis was made in all cases by either typical X-ray changes in the chest or phalanges, sarcoid changes in the skin, or by biopsy of a lesion. In six of the seven cases there was a uveitis, in two associated with a keratitis, and in one with a complicating secondary glaucoma.

Longcope and Pierson[3] reported two cases with ocular changes, one simulating uveoparotid fever, and the second having an enlargement of the superficial lymph nodes and the parotid and lacrimal glands. In the latter case the original diagnosis was Hodgkin's disease, which was later reinterpreted as Boeck's sarcoid. Four years after the onset of the glandular enlargement the patient showed typical skin lesions.

Walsh[8] added four new cases with ocular changes. One patient had an enlargement of lacrimal glands, which biopsy of a skin lesion proved to be sarcoid. The second had a bilateral mild uveitis. This patient showed mild transient palsies, and, except for the absence of enlarged parotid glands, a diagnosis of uveoparotid fever would have been made. In the third case sarcoid was diagnosed by section of an enucleated phthisic eyeball, and the last case presented a sarcoid of a subconjunctival mass.

It has been found that the tuberculin test in cases of Boeck's sarcoid is usually negative in uncomplicated cases and that it only confuses the correct diagnosis.

Case report

The case to be reported is unusual in its acute onset and bilateral involvement of the lacrimal glands with associated bilateral iridocyclitis. The diagnosis was made by biopsy of the lacrimal gland and

typical X-ray changes in the chest.

M. P., a 32-year-old colored female, was first seen in the receiving ward of the Cincinnati General Hospital on February 24, 1940, with a painful swelling of both eyelids. A urinalysis and complete blood count were negative, and she was referred to the eye clinic.

On March 6, 1940, she attended the eye clinic. Vision uncorrected in the right eye was 20/30 — 2 and in the left eye 20/40. The patient complained of blurring of the vision and some pain in the left eye of three weeks' duration. There was also a history of a painful swelling of each upper eyelid which had disappeared on the left side.

On examination the right upper eyelid was found to be swollen; the lacrimal gland was enlarged, firm, and slightly tender. The lobulations could be felt. The gland was not replaceable into the orbit by pressure. The lacrimal gland of the left eye was slightly palpable, but not tender.

The pupils were round, equal, 5 mm. in diameter, and reacted to light and accommodation, and consensually. There was a moderate circumcorneal injection in the left eye. Slitlamp examination revealed numerous small, round, grayish punctate deposits which formed a triangular shape with base down in the lower part of the cornea, a slight aqueous flare, a small yellowish nodule at the pupillary border of the iris opposite the 7-o'clock position, and several small areas of exudate about the pupillary margin. The iridocyclitis was interpreted as tuberculous. The examination of the right eye was essentially negative. The tactile tension in each eye was normal.

A search for possible foci of infection revealed negative dental, gynecologic, and urologic findings. A first- and second-strength tuberculin test (P.P.D.) was negative. The blood Wassermann test was negative. X-ray studies of the chest showed hilar shadows exaggerated bilaterally with no evidence of acting pathology.

The patient was hospitalized for further observation and treatment. Daily intravenous injections of sodium iodide (30 grains) were given. Typhoid "H"

Fig. 1 (Sniderman). Note swelling in right lacrimal-gland region and the bilateral circumcorneal injection.

antigen (20,000,000) was given twice intravenously at a three-day interval. The local therapy consisted of heat to the right-lacrimal-gland region, and 1-percent atropine drops in the left eye.

On the fourth day of hospitalization the patient developed an iritis in the right eye. There was a mild circumcorneal injection, and with the slitlamp one could see a few small scattered punctate deposits and a slight aqueous flare. No changes were noticed in the iris.

On the seventh day a biopsy of the right lacrimal gland was taken under intravenous evipal anesthesia. Sections were examined by Dr. R. Fuller, Dr. M. K. Asbury, and Dr. F. H. Verhoeff.

Dr. R. Fuller: "There were many nodular formations in the section with large macrophage cells and lymphocytes; also numerous giant cells, and no evidence of caseation." In the absence of clinical signs of Boeck's sarcoid a tentative diagnosis of tuberculosis was made. At Dr. Fuller's suggestion an acid-fast stain was made and found negative for organisms.

At this time an X-ray report by Dr. J. Singer was received, as follows:

"Examination of the chest demonstrates normal bony framework. The heart and mid-line structures are not displaced. The hilar shadows are very prominent and rounded. There is a generalized increase in the bronchovascular markings extending throughout the entire lung. The presence of the unexplained hilar adenopathy is compatible with the diagnosis of lymphoid type of Boeck's sarcoid."

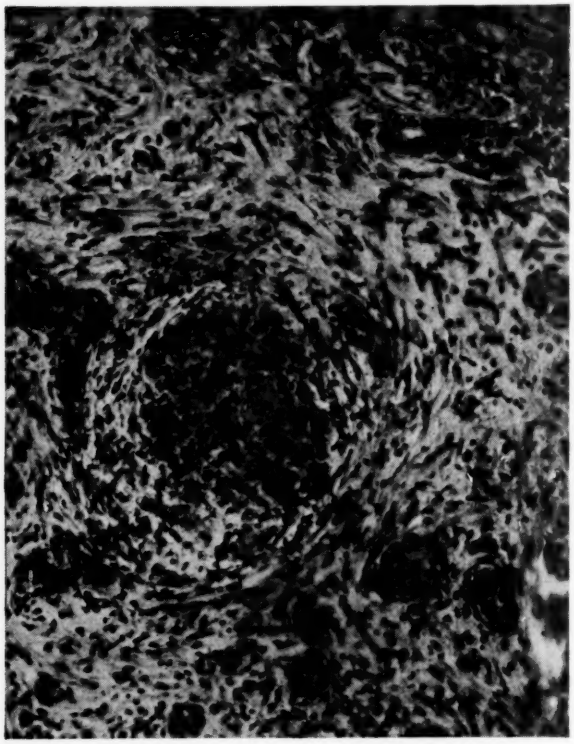

Fig. 2 (Sniderman). Photomicrograph of lacrimal-gland tissue ×200. Note "hard tubercle."

Following this, reports of the biopsy sections were received.

Dr. F. H. Verhoeff: "The section that you sent me, in my opinion, shows Boeck's sarcoid of the lacrimal gland. In all the specimens that I have considered to be Boeck's sarcoid of the lacrimal gland, giant cells have been very large and conspicuous, as in your case."

Dr. M. K. Asbury: "Histologically the lesions resemble the description of Boeck's sarcoid. There are collections of epithelioid cells without necrosis, sometimes without marginal inflammatory reaction, and there are large giant cells in which the nuclei are frequently evenly distributed instead of being marginated."

The patient was followed in the eye clinic and along with the local eye therapy was given a course of X-ray treatment to the region of the right lacrimal gland. The plan of treatment was: 140 KV—5MA; a 4-mm. aluminum filter at 40-mm. distance. The first dose was 100 r and then 200 r at weekly intervals. The lacrimal gland became progressively smaller and following the fourth treatment was no longer palpable.

The ocular changes were slow in improving. At no time was the reaction acute, and a posterior synechia in the left eye was the only complication. The tactile tension was normal in each eye.

In May, 1940, X-ray studies of the hands and wrists were normal, and a reëxamination of the chest showed a decrease in the size of both hilar shadows, although they remained decidedly enlarged. The findings were interpreted as being more suggestive of Boeck's sarcoid.

In June, 1940, the vision in the right eye with +0.50 D.sph. ⌯ +0.50 D.cyl. ax. 90° was 20/50, and with the same correction in the left eye was 20/20 — 4. The pupil of the right eye was dilated by atropine, and under slitlamp examination no evidence of pathologic disturbances in the eye was found. The pupil of the

left eye was irregularly bound down by posterior synechia. Under slitlamp examination only a few posterior punctate deposits were observed to remain, and these were becoming pigmented. A slight aqueous flare was still present, but no nodules were visible in the iris and no areas of atrophy.

Comment. In the cases reviewed in the literature it is of interest to note the variety of diagnoses made before the final diagnosis was reached. The discussion as to etiology has always centered about the question whether the lesion was tuberculous or non-tuberculous, and this is still undetermined. Similar discussions are found in cases reported as uveoparotid fever and of cases reported as sarcoid, both of which have an almost identical histologic appearance. Walsh,[8] Slot, Goedbloed, and Goslings,[9] Jersild,[10] and others conclude after a report of cases that uveoparotid fever and Boeck's sarcoid are identical or closely allied conditions. Savin[11] reviewed 66 published cases of uveoparotid fever and found 9 with enlargement of the lacrimal glands. There is no mention of a biopsy of any of these glands and it is possible that histologically some of them would have been interpreted as sarcoid. Hamburger and Schaffer,[12] in an excellent report, classify uveoparotid fever as a manifestation of Mikulicz's syndrome. Following the same line it is logical to include in this syndrome cases of Boeck's sarcoid similar to the one reported in which the lacrimal glands are involved, and in which iridocyclitis may be an outstanding and important concomitant. Wexler[13] reported a case of sarcoid of the lacrimal gland in which the diagnosis was made by the typical microscopic picture of "hard tubercles" without caseation.

Rosenbaum[14] reported a case of bilateral lacrimal-gland enlargement in which the diagnosis of sarcoid was made from the biopsy specimen, which showed small tuberclelike areas consisting of epithelioid cells and giant cells without necrosis.

Summary

A brief review of cases of ocular sarcoid is reported along with a new syndrome of bilateral involvement of the lacrimal glands with concomitant bilateral iridocyclitis. The diagnosis was made by biopsy of the lacrimal gland and typical chest X-ray changes. The treatment was not extraordinary except for X-ray therapy to the lacrimal gland, to which there was a good response.

Photographs were taken by Mr. J. B. Homan, assistant professor of Medical Art, Cincinnati Medical College.

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AN ATTEMPT TO PRODUCE DINITROPHENOL CATARACTS IN HYPOTHYROID RATS*

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In many individuals, the use of dinitrophenol to reduce weight has been associated with the subsequent development of cataracts. For this reason numerous laboratory investigations have been carried out in an attempt to establish a definite relationship between dinitrophenol administration and the production of lens opacities. Experiments in which this drug has been fed to laboratory animals have uniformly failed in the production of cataracts.[1] Further efforts in this study have involved feeding dinitrophenol over very long periods of time, with subsequent maintenance on a normal régime. In other instances, the experimental animals have been placed on diets predisposing them to cataract development; that is, high carbohydrate vitamin deficiency, and high lactose, and, in some cases, substances which caused marked diarrhea.[2, 3] In these attempts, as in the others, dinitrophenol administration failed either to produce or to aggravate the development of cataracts.

The present report concerns itself with a series of experiments in which dinitrophenol was administered to thyroidectomized rats. It was thought possible that some degree of hypothyroidism existed in those clinical cases in which dinitrophenol was taken to reduce obesity, and that the hypothyroidism was a predisposing factor in the production of the cataracts that occurred. In a series of 130 rats thyroidectomized when very young, cataracts were observed in only two instances, a frequency which does not necessarily indicate a causal relationship to the hypothyroidism. A second series of 55 rats were thyroidectomized when 17-19 days of age and supplied with drinking water that contained 75-100 mg. percent 2,4-dinitrophenol. They were fed an adequate stock diet that maintains the rat-breeding colony in good condition. Dinitrophenol administration began immediately following the thyroidectomy. Preliminary tests revealed that drinking water containing as much as 100 mg. percent dinitrophenol resulted in the death of a large proportion of the experimental animals if they were maintained on this régime for a week or 10 days. For this reason the concentration of dinitrophenol was increased slowly

* From the Department of Ophthalmology, College of Physicians and Surgeons, Columbia University, and the Institute of Ophthalmology of Presbyterian Hospital. Aided by a grant from the Francis I. and Elizabeth C. Proctor Fund.

from 75 mg. percent to 100 mg. percent. Even then the mortality rate in this experiment was high. Dinitrophenol was administered steadily for 4.0 to 4.6 months, at which time ordinary drinking water was given and maintained three more months. Twenty-two rats survived to autopsy. The effect of the thyroidectomy was obvious in all cases in the stunted growth. In only two cases did search for remnants of thyroid tissue reveal incomplete removal of the gland.

The eyes were enucleated and examined; then the lenses were removed and placed in normal saline. These were carefully examined with a binocular microscope at 20× magnification, and illuminated by a narrow slit-shaped beam of light. Structure of the rat lens could be made out very well in this way. Both anterior and posterior suture systems, the course of the superficial lens fibers, and the fetal nucleus could be well investigated. In only one lens was any opacity noted. This was in the form of a thin opaque layer covering about one fourth of the anterior surface, lying near, but not in, the most superficial position. The lens of the other eye of this individual was normal.

In this series of experiments dinitrophenol has been administered continuously in near lethal quantities over a period of 4.0 to 4.6 months. This period began within the first few days after opening of the palpebral fissures, at which time embryonic differentiation of the eye (retina) had just been completed, and at a time when active growth of the lens was beginning. In none of these cases did cataracts develop that could be ascribed to the action of dinitrophenol, either during the period of its administration or in the subsequent three months. This latter period provided an opportunity for incipient lens changes to mature and is of importance inasmuch as many clinical cases of cataract attributed to dinitrophenol were first noted some time after administration of the drug had ceased. The marked hypothyroidism to which these animals were also subjected was apparently without effect in inducing the formation of lens opacities.

This study confirms the many other reports that dinitrophenol administration to laboratory animals does not result in development of cataract, and extends such studies to include hypothyroid animals.

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STREPTOTHRICOSIS OF THE LACRIMAL CANALICULI*

Report of nine cases

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Streptothricosis of the lacrimal canaliculi is a chronic fungus infection occurring in one or both canaliculi. The condition is relatively uncommon. In 1907, Derby[1] stated that 50 cases had been reported in the literature, and in 1920 Nagel[2] had noted only four reported cases in America.[3, 4] Since then, six additional cases[5, 6, 7, 8, 9] have been reported in this country. The European literature contains infrequent case reports[10, 11, 12, 13, 14, 15, 16, 17] that have been well summarized by Valière.[18]

Etiology

The etiological agent has long probably been incorrectly classified as Streptothrix försteri. Extensive studies of cultures and animal inoculation by Grüter[19] showed that the mycelium belongs to the Actinomycetaceae. Dodge[20] has classified the fungus as Actinomyces försteri.

Clinical appearances

Two clinical types are recognized; namely (a) those with canalicular signs predominating, and (b) those with marked conjunctival reactions without apparent canalicular signs.

(a) Form with Apparent Canalicular Signs. An elongated, firmly resistant mass is felt over the canaliculus, generally about 4 mm. by 6 mm. in size. Usually the lower canaliculus is involved. The corresponding punctum may or may not be reddened, dilated, or pouting. A mucopurulent discharge may be present at the inner canthus. Epiphora and a mucopurulent secretion of long duration are usually the chief complaints.

(b) Form without Apparent Canalicular Signs but Simulating a Conjunctivitis. The condition is always unilateral. The conjunctiva adjacent to the punctum may be mildly inflamed or there may be a pronounced acute conjunctivitis of both the palpebral and the bulbar conjunctivae. Acute catarrhal corneal ulceration may supervene. Considerable mucous secretion is present on the lid margins, and the suppuration may be greater than the objective signs of the conjunctivitis would suggest.

In both types, when the canaliculus is pressed upon, many concretions may be expressed. The younger concretions are grayish-green in color; the older forms, brown or dark brown. They are hard and friable, and are easily crushed between two cover glasses. The concretions contain calcium monophosphate and carbonate. The amount may reach as much as one cubic centimeter. However, concretions are not always expressed. In these cases, a cheesy, finely granular or mucoid pus may be extruded. Following the expression of the contents of the canaliculus, the duct may be irrigated through into the nose. In long-standing cases, stenosis of the canaliculus may supervene, thus preventing the passage of fluid into the nose.

Bacteriological findings

Smears stained by the Gram method show masses of long, irregular filaments with branching ends. The branching is more apparent in hanging-drop prepara-

* From the Department of Research, New York Eye and Ear Infirmary. Revision of paper, with two added cases, read before the New York Academy of Medicine, Section of Ophthalmology, May 20, 1940.

tions or by dark-field illumination.[21] The filaments are beaded and are mostly gram-positive. The smears also show masses of pus cells and numerous bacteria. The bacteria are for the most part gram-positive cocci with occasional gram-negative small rod forms (fig. 1).

The Streptothrix is diffiult to grow by ordinary laboratory methods. When cultured aërobically, staphylococci, streptococci, and pneumococci usually overgrow the fungus. Axenfeld[22] grew the fungus anaërobically on acid media. In three days Ruys[21] incubated anaërobically a pure culture on glucose-agar plates. Hagedoorn[23] has recently suggested the use of 95-percent alcohol to destroy secondary bacteria. Khorazo[24] was able to grow the fungus from one of the cases in this series in 72 hours aërobically and anaërobically on chopped-meat broth enriched with ascitic fluid. In both instances a long filament grew out but was mixed with staphylococci. In order to separate the filament from the staphylococci, a loop of the mixed culture was added to a dextrose deep-pour agar tube which had been melted and cooled to 45°C. After 72 hours' incubation the tube was cut, and single colonies were picked and inoculated into chopped-meat broth with the addition of ascitic fluid. These procedures were repeated several times until a pure filament was isolated.

The Streptothrix has only a slight pathogenicity for animals. Axenfeld[22] stated that intravenous injection in rabbits produced no results, but intraperitoneal and subcutaneous injection in guinea pigs and white mice produced a free local suppuration.

Mode of infection

There has been no well-demonstrated explanation of the exact manner in which the Streptothrix infection arises. The theory that this is an occupational disease of agriculturalists is not substantiated. The theory is advanced that the fungus, in the form of spores, is lodged on the conjunctival epithelium from the air. The fungus then enters the canaliculi with the tears, and within the anaërobic location of the canaliculus the fungus will grow satisfactorily.

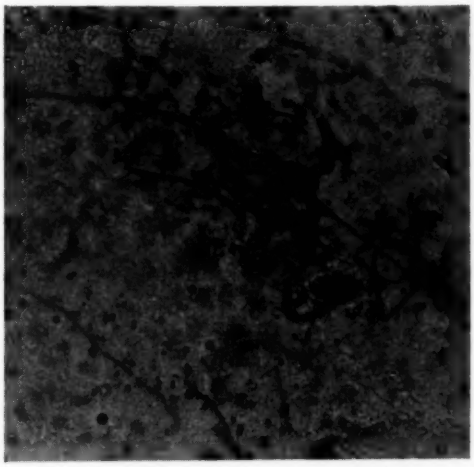

Fig. 1 (Elliot). Smear of excrement from canaliculus showing filaments of Streptothrix, bacteria, and pus cells (× 2,000).*

Report of nine cases of the disease

Nine cases of streptothricosis of the canaliculi have been diagnosed in the eye clinics of the New York Eye and Ear Infirmary during the past two years.

Age, sex, and occupation. All the patients were females, the youngest being an American schoolgirl, 10 years of age. Two of the patients were a bookkeeper 24 years of age, and a milliner 27 years old. One was an Italian housewife 37 years of age. The remaining patients were housewives between 46 and 58 years of age, and were born in central Europe. All the patients lived in the city and all, except one, were Jewish (45 percent of

* Photographed by Dr. Donald W. Bogart.

the patients in the eye clinics of the New York Eye and Ear Infirmary are Jewish).

Chief complaint. Tearing was the chief complaint in seven cases. In eight cases the patient complained of pus at the inner angle of the eye. One patient complained of marked redness of the eye and adherence of the lids. The duration of the complaints varied from one month to three years.

Canaliculus involved and condition of punctum. In five cases the lower canaliculus was involved, while in two only the upper canaliculus was affected. In the remaining two cases, both upper and lower canaliculi contained concretions, and in both the puncta were very inflamed and pouting. Four of the cases showed very slight swelling and inflammatory changes around the punctum, while in three no macroscopic changes of the puncta were observable.

Associated conjunctivitis. One patient had an acutely inflamed bulbar and palpebral conjunctiva. Five showed moderate or minimal conjunctivitis at the inner angle adjacent to the punctum, and there was no conjunctival reaction in three cases.

Irrigation of canaliculi. In three of the cases there was a stenosis at the distal end of the affected canaliculus that was not removable by probing. In the remaining six cases irrigation through the nose was readily possible after the expression of the material within the canaliculus.

Macroscopic appearance of excrement; microscopic and cultural findings. In seven of the patients, typical concretions were expressed, while in the other two concretions were not obtained at any time. In the latter cases, a mucopurulent, cheesy material was always found upon pressure over the canaliculus. The direct smears showed typical Streptothrix in all cases, while there was an abundance of pus cells, gram-positive cocci, and a few short gram-negative rods. The Streptothrix was cultured in one case anaërobically and aërobically in 72 hours on chopped-meat broth enriched with ascitic fluid.[24] Other bacteria found were hemolytic staphylococcus aureus (toxic strain), streptococci, pneumococcus type XIV, and pseudo Klebs-Loeffler bacilli. Intraperitoneal injection into a white mouse did not kill the animal at the end of one week. The intracutaneous injection of 0.5 c.c. of an emulsified culture in broth into a guinea-pig produced a nodule, 10 mm. by 12 mm. in size, within four days.[24]

Therapy. The canaliculus was slit in two patients. All were given frequent dilation of the punctum, curettage, and manual expression of the canaliculus. Manual expression of the canaliculus was facilitated by placing a glass spatula in the conjunctival fornix and milking the contents of the canaliculus towards the punctum with digital pressure directly against the spatula. Lugol's iodine was then instilled into the canaliculus and 10 drops of a saturated solution of potassium iodide three times a day was administered orally. Mineral oil was instilled into the lower fornix to protect the cornea from trauma—which may occur if Lugol's iodine is used in excessive amounts. Other antiseptics used occasionally were metaphen 1:2,500, 2-percent aqueous mercurochrome, 1-percent aqueous gentian violet.

Period of treatment and observation. Weekly treatments were given. It was observed that the patients in whom concretions were obtained were free of signs and symptoms after two or three treatments. In the cases in which mucopurulent excrement and concretions were present, the period of treatment extended up to six or eight weeks. In the two

instances in which mucopurulent material only was found, the course of treatment was prolonged; in one case, after weekly treatments for about one year, the patient was finally treated daily for two weeks before the signs and symptoms were removed. The period of observation extended to two years in one case. The others were followed from 6 to 12 months.

Resulting condition of canaliculus. The canaliculi which were not stenosed on the first examination did not become closed at any time during treatment. The three cases showing stenosis at the distal end of the canaliculus at the outset were unchanged after treatment.

Discussion of clinical results. One of the patients did not return for treatment regularly. All the remaining patients were free of signs and symptoms, and in none of these was Streptothrix demonstrable after the course of treatment.

Comment

Streptothricosis of the lacrimal canaliculi is of importance in the differential diagnosis of chronic dacryocystitis, chalazia at the inner canthus, acute or chronic unilateral conjunctivitis, and acute trachoma. One of the patients in this series had had a dacryocystorhinostomy performed and, following operation, the diagnosis of streptothricosis of the canaliculi was made. Several were, at first, considered to be cases of chalazia until the lacrimal apparatus was investigated. Acute unilateral conjunctivitis always warrants a careful examination of the canaliculi. In all cases the exact site of the obstruction in the lacrimal apparatus should be localized, and both upper and lower canaliculi should be investigated. The diagnosis of streptothricosis of the lacrimal canaliculi can be made clinically with considerable certainty, when on pressure over the lacrimal canaliculus (not the lacrimal sac), concretions or mucopurulent material is obtained. Definite proof of the diagnosis is made by microscopic examination of the direct smears.

Summary and conclusions

Nine cases of streptothricosis of the lacrimal canaliculi are reported. All the patients were females, the majority of whom were between the ages of 46 and 58 years.

Pus at the inner canthus and epiphora were the chief complaints. One patient had an acute unilateral conjunctivitis.

In two of the cases, both upper and lower canaliculi were involved, while in two others, only the upper canaliculus was affected.

The patients in whom concretions only were expressed were cured in two or three treatments, while when a mucopurulent material was obtained the treatment had to be prolonged.

Treatment consisted of frequent dilation of the punctum, curettage, and manual expression of the canaliculus. Lugol's iodine was instilled into the canaliculus and potassium iodide was given by mouth.

218 Second Avenue.

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NOTES, CASES, INSTRUMENTS

KRUKENBERG SPINDLE ASSOCIATED WITH MEGALOCORNEA AND POSTERIOR PIGMENTATION OF THE LENS

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Krukenberg spindles in association with posterior pigmentation of the lens[1] has been reported by Zentmayer,[2] who suggested that the pigment comprising the spindle was derived from the lens pigment. This case is reported because it seems fairly certain that the pigment is derived from the iris. The association with megalocornea is also noteworthy.

P. C., a white man aged 21 years, of German-French-Irish descent, came to the office "for new glasses." A myope, he was accustomed to be refracted about every 18 months, and, according to his statement, his various ophthalmologists had never found anything abnormal. His only complaint was that his distance vision was slightly hazy. The past medical history was negative except for measles, German measles, and an attack of "kidney trouble" at the age of 11 which kept him in bed for three months. Subsequent urinalyses have all been negative. The family history is negative for ocular disease. One brother was examined by me and found to be normal.

Examination: Vision was R.E., 20/100; L.E., 20/50 plus 3. Under homatropine cycloplegia R.E. —1.00 D.sph. ⊂⊃ −0.75 D.cyl. ax. 75° vision was 20/20−3; L.E. −0.75 D.sph. ⊂⊃ −0.50 D.cyl. ax. 30° vision was 20/20−2. The post mydriatic correction was R.E. −1.25 D.sph. ⊂⊃ —0.75 D.cyl, ax. 70° = 20/20 −3; L.E. −0.75 D.sph. ⊂⊃ −0.50 D.cyl. ax. 30° = 20/20−3. With pinhole glass, vision in the right eye was not improved, but in the left eye brighter. Accommodation was normal in each eye.

The lids, lacrimal apparatus, and conjunctiva were normal, as were also the ocular rotations. There was no diplopia with a red glass. The cornea of the right eye measured 13.0 mm. by 12.5 mm.; that of the left eye, 13.5 mm. by 13.0 mm., the long meridian being horizontal. On the posterior surface of each cornea there was a brown spindle-shaped opacity measuring about 4 mm. in height and 0.9 mm. in its greatest width. The opacities both lay in the 90-degree meridian with their centers just below the lower margin of the pupils. Both anterior chambers were nearly twice the normal depth, and the irides lay flat rather than at their usual obtuse angle with the anatomic axis. The pupils were round and equal with prompt reaction to light and accommodation.

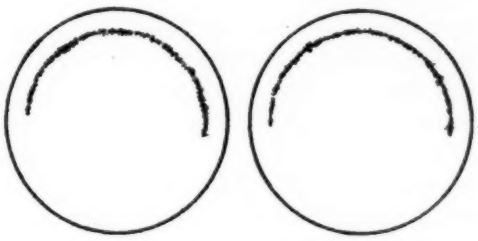

Fig. 1 (Cameron). Diagrammatic illustration of position of pigment on posterior lens capsule.

With the pupils dilated a semicircle of pigment was seen on the posterior sur face of each lens. This jagged line of pigment was situated only in the upper half of the two lenses. Transillumination of the brown irides showed a well-advanced iris atrophy.

A few small vitreous opacities were present in each eye. The discs were of good color, with physiologic cups. A nar-

row myopic crescent was present in each eye. The fundus vessels were normal; the distribution of retinal pigment was also normal. The choroidal vessels were not visible. No exudates nor hemorrhages were seen. The ocular tension was normal in each eye.

Slitlamp examination: The cornea of each eye seemed to be thinner than normal. The spindles were comprised of pigment particles closely aggregated into dots, rings, and incomplete rings (arcs and semicircles) which lay on or in the endothelium. The pigment rings were about the size of the denuded areas seen in a beaten silver cornea, and a few had a central dot. Surrounding the spindles in a triangular zone the posterior corneal surface was diffusely dotted with pigment in the form of dust, dots, rings,[3] and incomplete rings. The periphery of the cornea and its upper one fourth was free of pigment. The corneal endothelium was intact in the triangular zone of precipitation. The corneal nerves in the pupillary area of the cornea seemed to be increased in number. There were no inflammatory K.P. present.

There was no aqueous flare. Floating in the aqueous occasional fine dustlike dots of pigment were seen, similar to those seen in the aged and in some cases of chronic glaucoma.

The iris presented the usual picture of iris atrophy. Iris vessels were plainly visible, especially in the middle third. In the depigmented stroma were clumps of pigment which gave it a freckled appearance. No Koeppe nodules were present. No dust was seen in the crypts. A slight iridodonesis was present in each eye. One or two tags of persistent pupillary membrane remained.

A grouping of congenital pigment stars was present on the anterior surface of each lens. This was not unusually heavy. A fine deposit of pigment dust, thin and sparse, lay on the anterior capsule. This dust was not grouped into rings. Posteriorly, a semicircular line of pigment lay on the capsule of each lens about 2 mm. from the equator. The line was made up of discrete, roughly rectangular masses of pigment, closely arranged, with their long axes directed towards the ciliary body. In color they were darker than the spindles and looked like the end of ciliary processes. No pigment dust could be seen on the posterior capsule, in the retrolental space, or on the anterior hyaloid.

Since Krukenberg first described the spindles in 1899 about 40 cases have been reported. The first cases were uncomplicated by other ocular disease, which led to the conclusion that the deposit was a congenital one somewhat analogous to the pigment stars seen on the anterior surface of the lens. As more cases were studied, however, it was found that myopia occurred in a very high percentage (32 of 36 cases collected by Edgerton[4]). Vail[5] called attention to the frequency of Krukenberg spindles as a complication of megalocornea, and in his discussion of the characteristics of megalocornea listed it as a minor sign of the primary disease. That the disease may be acquired is confirmed by Koby's[6] report of a typical case developing four months after an attack of iritis.

As more of these cases have been reporter,[3, 4, 5, 7] theories on the formation of Krukenberg spindles have evolved into attempts to explain the source of the pigment and the reason for its unusual grouping. It would seem evident that this is an acquired disease,[8] occurring when two abnormal conditions concur: (1), the release into the aqueous of fine pigment granules in fairly large amounts, and (2), a change in the corneal endothelium which allows the pigment to adhere to the cornea or be phagocytized by the endothelium. In Lüssi's line we have a

formation somewhat similar to that of the spindles, with no apparent change in the endothelium. Hanssen, who examined one of these cases microscopically, found the pigment in the endothelial cells in the form of fine dust. The normal thermal current of the aqueous should explain the spindle form but why the pigment is thickly deposited in one case and not in another is difficult of explanation. In essential atrophy of the iris,[9,10] pigment granules are released into the aqueous in considerable amounts over a long period of time and yet Krukenberg spindles are not a characteristic of the disease. Possibly one is justified in assuming from this that there is no change in the corneal endothelium (such as may occur in megalocornea). Here too we have the question of whether the chemical structure of the pigment granules is similar in different disease conditions. It is possible that the final explanation will lie in a better understanding of the chemical changes[11] that occur when the complex melano-proteins of the pigment granule are released from combination with tissue.

Summary

1. A case of Krukenberg spindles in association with megalocornea and anomalous pigmentation of the lens is presented.

2. From the absence of free pigment behind the lens it may be inferred that the pigment is derived entirely from the iris.

3. The pigment is deposited over the anterior of the lens and over most of the posterior surface of the cornea, the spindles being the area of the heaviest deposition of pigment on the cornea.

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A NEW CAPSULE FORCEPS*†

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New York

In spite of the many capsule forceps which have been devised, the capsule forceps described here are presented because they are designed primarily for two purposes, for which they are apparently satisfactory: (1) for dislocating the anterior capsule of the lens below the lower pupillary margin, where the capsule is thick-

* Aided by a grant from the Ophthalmological Foundation, Inc.

† Made by V. Mueller and Company, Chicago, Illinois.

est and, if necessary, because of a round pupil, to tumble the lens and deliver it without changing the hold on the capsule; (2) for grasping the upper part of the anterior capsule between the equator and

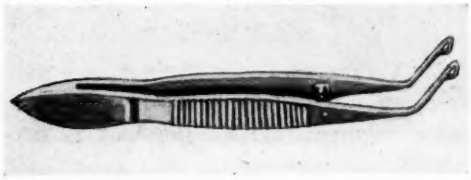

Fig. 1 (Berens). A new capsule forceps.

the anterior pole where it is thickest and either by traction or counter-pressure removing the lens without dislocating it below. It is preferable to dislocate the lens below first and then shift the hold of the forceps to the upper part of the capsule and deliver the lens by traction and counter-pressure.

The shafts of the forceps are 90 mm. in length, the neck is 6.5 mm. in length, and the grasping semilunar tip 2 mm. in length by 2 mm. in breadth. The tip of the capsule is a small replica of the Walker tip.[1]

Two models are available, one a crossed-action forceps which permits relaxation of pressure on the shafts after the capsule is grasped, and the other a direct-action forceps (fig. 1).

35 East Seventieth Street.

REFERENCE

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AMERICAN BOARD OF OPHTHALMOLOGY*

CASE REPORT

C. H. ALBAUGH, M.D.
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FINAL DIAGNOSIS: BILATERAL GONORRHEAL OPHTHALMIA

SUMMARY

This is the case report of a 10-year-old boy with bilateral gonorrheal ophthalmia, who was treated with sulfanilamide. At first the improvement was satisfactory, but a drop in the blood level of the drug allowed an exacerbation of the disease to occur. Reëstablishment of the blood level of sulfanilamide was followed by improvement and cure of the disease, but not without the appearance of general complications which required transfusion. The final result of the treatment was excellent.

F. B., a 10-year-old white boy, was admitted to the Massachusetts Eye and Ear Infirmary (unit No. 188261) on April 19, 1939, and was discharged on May 24, 1939.

* The case report herewith published was submitted by the American Board of Ophthalmology as representative of the type of report desired by the Board.

In publishing these case histories the Journal departs from its usual method of avoiding special headings and presenting a narrative description in order to conform with the style approved by the American Board of Ophthalmology. The Journal will from time to time present such case histories submitted by the Board in order to encourage a high type of case reporting and to recognize meritorious reports.

Previous History

Because the parents were not present when the patient was admitted, no previous history was obtained for the record. The mother was questioned at a subsequent time and stated that the child had always been healthy.

Present History

The patient had had no eye complaints until four days before admission. He awakened that morning to find the right eye sealed shut with crusts. The eyes generally became red and sore, and a yellow creamy pus appeared in the conjunctival sac. For two days the patient's mother treated the eye with boric-acid irrigations, but because no remission of symptoms followed, she called the family physician who in turn called in an oculist. The latter referred the patient to the Infirmary.

Until shortly after the patient had been discharged, no reliable present history could be obtained from the family. Finally, after confidence had been established between the mother and the examiner, the following history was obtained:

The probable source for the infection was the patient's father. He had had an acute urethritis, which the local physician diagnosed as gonorrheal. This urethritis had been present for several weeks before the patient was affected.

Physical Examination

As is customary at the Massachusetts Eye and Ear Infirmary, this examination was made by the Pediatric Service of the Massachusetts General Hospital. The results of the physical examination were entirely negative except for the observation that the child had no uvula, and that the eyes were involved in a local process.

The Urological Service of the Massachusetts General Hospital was called in consultation in order to ascertain whether the child had any signs of gonorrhea in the urethra. It was reported that there was no evidence of gonorrheal urethritis and that it was believed that the source of infection was undoubtedly some member of the family.

Eye Examination

O.D. Examination with the focused-beam flashlight and a loupe was productive of the following observations: The lids were very swollen, red, and indurated. The palpebral conjunctiva was chemotic, fiery red, and velvety in texture. The cornea was clear and took no fluorescein stain. A thick, creamy discharge welled up from the conjunctival sac.

O.S. There was only slight conjunctival injection. The cornea was clear and did not stain with fluorescein.

Laboratory Reports

Smears and cultures (blood-agar medium) were taken from each eye at the time of admission. The smears were stained by the Gram method and were examined at once. Study of the cultures 48 hours later confirmed the smear findings:

Smear O.D.: Loaded with pus cells, many of which contained as many as 50 gram-negative intracellular diplococci.

Smear O.S.: No organisms were seen, only occasional pus cells were evident.

The patient was sent to the ward and was put on a régime that is routine for this type of case:

(1) Buller's shield O.S.

(2) Two-percent boric-acid-solution irrigations O.D. as often as necessary to keep the eye free of exudate.

(3) One-half-percent zinc-sulphate solution every two hours in both eyes.

(4) One-percent atropine-sulphate so-

lution in the right eye three times daily.

(5) Ten-percent protargol in both eyes three times daily.

Because the use of sulfanilamide was planned, the blood-cell counts and urine were checked at once.

Blood—WBC, 11,900; RBC, 4,800,000.

Urine—entirely normal.

Clinical Progress

The administration of sulfanilamide was begun on the evening of the day of entry. Since the patient weighed about 80 pounds, the dose was set at 100 grains by mouth daily.

The following morning the cornea of the right eye stained with fluorescein over about three quarters of its area. The bulbar conjunctiva had become quite chemotic and a "gutter" had formed at the limbus. Furthermore, smears were now positive for gonococci in the left eye. Treatment was ordered for both eyes and the dose of sulfanilamide was increased to 120 grains daily.

On April 22, 1939, the fourth day of hospitalization, the blood level of sulfanilamide was 15.6 mg. percent, and the right eye showed staining only in the lower half of the cornea. The involvement was quite superficial. Smears from both eyes had become negative for gonococci, although they still showed many pus cells. The discharge had become less abundant in the right eye and was minimal in the left.

On April 25, 1939, the seventh hospital day, the blood level of sulfanilamide was 13.1 mg. percent, and the right eye seemed worse in that, although the staining was less in extent, the appearance of a dark-green color suggested that the lesion was becoming deeper. The lesion was almost limited to an area below the pupillary border, about 2 mm. in diameter. Smears were again negative for gonococci.

By April 27, 1939, the ninth hospital day, the contral portion of the ulcer in the right eye had begun to bulge as does a descemetocele, and the discharge from the left eye had increased in amount. Smears were still negative. Study of the situation revealed that the blood level of sulfanilamide had fallen to 10.6 mg. percent because the child had been drinking large amounts of fluid. The drug had thus been washed out of the body through the kidneys.

In view of the grave condition of the eyes, in consideration of the youth and excellent physical condition of the patient, and after consultation with Dr. Champ Lyons, surgeon-bacteriologist from the Massachusetts General Hospital, drastic measures were taken. The dose of sulfanilamide was increased to 180 grains a day and the fluid intake was carefully limited to 1,500 c.c. a day. The rise in sulfanilamide level from 10.6 mg. percent on April 27th, to 19.6 mg. percent on April 28th, and to 24.4 mg. percent on May 1st, was accompanied by, at first, a gradual, then a rapid improvement in the condition of the eyes. By May 5th, there was almost no discharge from either eye, smears were negative, and the ulcer in the right eye had begun to heal, as was evidenced by the reduction in the bulging and the penetration of vessels inward toward the ulcer from the limbus below. The irrigations were stopped.

Meanwhile, however, difficulties had been encountered. The patient had gradually become dehydrated and nauseated, and developed a distinctly dulled sensorium. The temperature gradually rose to fluctuate near 104°F. and the red-blood-cell and white-blood-cell count dropped from values of 4,800,000 and 13,000 on entry to 2,500,000 and 5,300, respectively, on May 3d.

Therefore, on May 3, 1939, the fifteenth hospital day, the administration of

sulfanilamide was stopped. After proper blood typing and cross matching had been checked, the patient was given 400 c.c. of whole blood intravenously. This was followed with 1,000 c.c. of 5-percent glucose in saline intravenously.

The general physical response was excellent, for by May 5, 1939, the patient was definitely better in all respects. The eyes had improved markedly. There was no discharge from the right eye, the conjunctiva was only slightly red, and there was only a slight ptosis of the right upper lid.

The patient was discharged on May 24, 1939, and given 0.25-percent zinc-sulphate-solution drops for instillation in both eyes three times a day.

Out-Patient Visits

June 6, 1939: vision (uncorrected) was: O.D., 20/30−3; O.S., 20/30.

Examination was made with the aid of the bright flashlight, the slitlamp, and corneal microscope, and with the ophthalmoscope. The left eye was completely white and quiet. The right eye showed a vessel-infiltrated scar below in the position which the ulcer had occupied. The scar involved approximately two thirds the depth of the cornea. The fundus of both eyes was perfectly normal. There was also a slight residual ptosis of the right upper lid.

August 16, 1939: Examination was carried out as before. The patient had used 0.5-percent atropine sulphate in the eyes three times a day for the preceding three days. Refraction revealed the following:

O.D., −0.25 D.sph. ⌯ −0.75 D.cyl. ax. 90° = 20/15−6; O.S., −0.25 D.sph. ⌯ −0.25 D.cyl. ax. 60° = 20/15.

This was given as the prescription. The patient was advised to return to the hospital for a check-up examination in one year.

Discussion

This case has demonstrated:

(1) That there is a minimum blood level of sulfanilamide for maximum therapeutic efficiency. In this case it would seem to be about 15 mg. percent.

(2) That the methods of elimination of the drug must be taken into consideration in order that the blood level may be maintained without the use of unduly large doses.

(3) That the use of sulfanilamide in adequate doses is not without danger. The blood picture must be watched carefully (in this case counts were made daily during administration of the drug), and in each case preparations should be made for transfusion at the time the medication is started.

(4) That smears may be negative for gonococci very soon after the drug is in use, but that the organisms are not necessarily killed, for they continue their destructive effects.

Much has been learned about the use of sulfanilamide in the last year, hence these points are recapitulatory. However, at the time the case was seen, the lessons it taught were most valuable in the subsequent treatment of patients by this method.

630 West One hundred sixty-eighth Street.

SOCIETY PROCEEDINGS

CHICAGO OPHTHALMOLOGICAL SOCIETY

March 18, 1940

EARLE B. FOWLER, *presiding*

CLINICAL MEETING

SEPARATION OF THE ZONULAR LAMELLA FROM THE ECTOPIC LENS

DR. P. C. KRONFELD said that this patient, a white man, aged 40 years, presents the picture of a bilateral spontaneous dislocation of the lens. In the right eye the lens has left the patellar fossa altogether and is lying on the lower portion of the ciliary body. In the left eye the lens is dislocated downward and to the temporal side to such an extent that an upper-nasal segment of the pupillary area is rendered aphakic. In this aphakic area one can see a portion of the equator of the lens that is not quite so smooth as is usual. Separated from the equator by an optically empty space of measurable width and parallel with it, a delicate curled-up glassy membrane appears to be suspended on the normal-looking zonular fibers.

This picture is interpreted as a separation of the zonular lamella from the equator of the dislocated lens. At the time of the publication of von Szily's review of the pathology of the lens in Henke-Lubarsch's Handbook of special pathology, in 1937, only two cases of this condition had been reported (Meesmann, Arch. f. Augenh., 1922, v. 91, p. 261; and Stein, Klin. M. f. Augenh., 1926, v. 76, p. 75), to which Vogt added two more cases. While ordinarily in dislocations of the lens either the zonular fibers themselves or their insertion into the lens breaks, in the case presented the break in continuity has occurred within the lens capsule, the zonular lamella remaining connected with the zonular fibers, and the inner layers of the lens capsule staying with the lens.

CONGENITAL ABDUCENS INSUFFICIENCY

DR. HALLARD BEARD presented B. J., aged 10 years, who was first seen in January, 1934, with a convergent squint. The right eye could not be abducted beyond the primary position, a condition that had existed since birth. Vision R.E. was 0.8 + 1, L.E. 1.0 − 3. One month later a guarded tenotomy of the medial rectus muscle was performed with the result that abduction was increased about 10 degrees. On August 17, 1937, a second operation was performed on the right eye, in which the lateral halves of both the superior and inferior rectus muscles were brought over to the insertion of the externus and anchored there. This operation resulted in a considerable enophthalmos and limitation of movements of the globe in all directions. In December, 1937, the palpebral fissure could be opened only 4 mm., and the eye was immobile and endophthalmic. An operation was done to free adhesions but without apparent benefit.

In July, 1939, an operation was done to sever an adhesive band that had formed between the external canthal ligament and the temporal rim of the orbit. The enophthalmos persisted as well as the almost complete absence of motility of the eyeball.

Enophthalmos and impaired motility in this case appear to be due to extensive periocular adhesions and contractures of the external muscles. If the adhesions are freed surgically, they will surely re-form, but if they can be made to form at points farther back on the eyeball there should be less tendency to enophthalmos. The

case was presented to elicit suggestions as to therapy.

Juvenile glaucoma

Dr. Edward J. Horrick presented a woman, aged 25 years. She was first seen a month ago, complaining of pain in and about the right eye and poor vision in this eye, for a period of about a year. The eye had never been congested. There was no history of injury or infection.

On examination the right eye was found to be blind. It was of normal size and appearance. There was no congestion. The anterior chamber was of a little more than normal depth, perhaps 1 mm. The blue iris had a typical congenital coloboma, from the 11:30- to the 12:30-o'clock position. Media and lens were clear, and the fundus was normal except for deep glaucomatous cupping of the optic disc. The tension was 72 mm. Hg. The left eye was normal.

This case of juvenile glaucoma with congenital anomaly of the eye, deep anterior chamber, and high tension illustrates the long onset of these conditions, in which the youthful eyeball may stretch and accommodate itself to the tension.

About two weeks ago a filtering operation was done for relief of the constant severe ache in and about the eye. The tension was much reduced.

Juvenile exudative macular retinitis

Dr. James W. Coombs said that D. W., aged 30 years, was admitted to Research Hospital in October, 1939, complaining of loss of vision in his left eye of 10 months' duration. There was no history of disease, pain, nor inflammation in the eye. On examination the vision R.E. was 20/12; L.E., light perception.

Fundus examination revealed a pale, irregular, slightly elevated area in the left macula with blood vessels apparently coursing over the periphery of the lesion. There was an elevation of about 1 D. in this area. A pale, velvety area surrounded both discs. The disc margins appeared blurred. Normal physiologic cupping was present in both discs.

In November, 1939, a small, pinpoint, fresh hemorrhage was seen on the temporal side of the macula in the left eye. Blood pressure was 110/70. Blood chemistry, blood Wassermann, and spinal-puncture examinations gave negative results. No foci of infection were discovered. Mantoux test with P.P.D. number 1 was faintly positive in 48 hours, with P.P.D. number 2, strongly positive.

Unilateral exophthalmos

Dr. Roosevelt Brooks said that this white woman, aged 31 years, was first seen in September, 1939. She complained of headache and pain in the right eye of two years' duration. The pain was periodic and lasted one day. The right eye was exophthalmic, which condition had been growing steadily worse.

Vision R.E. was 0.4, L.E., 0.5 − 1. The right eye was proptosed. The upper lid was lower than that of the left eye. No tumor mass could be felt behind the eyeball. Pupils, tension, and discs were normal. Blood Wassermann test and urinalysis were negative. The peripheral fields were normal. Under homatropine refraction the vision was R.E., −1.50 D.sph. = 0.8 + 2; L.E., −0.25 D.sph. ⊂⊃ −1.0 D.cyl. ax. 750° = 1.2−3. Repeated X-ray studies for tumor of the orbit or ethmoid infection were negative.

The patient was referred to the Ear, Nose, and Throat Department where exploration of the right frontal sinus was performed. During the operation fatty tissue, under pressure, was found in the orbit. The frontal sinus was negative.

This is considered a case of lipoma of the right orbit.

Bilateral cataract with iritis and secondary glaucoma

Dr. Roosevelt Brooks presented a white woman, aged 52 years, who was first seen in February, 1939. Complaint at that time was blurred vision. There had been gradual loss of vision over a period of one year. She was under treatment for diabetes.

Vision was R.E., 5/200; L.E., 1/200. An opaque white mass was observed behind the pupil in each eye. The iris shadow was absent; tactile tension, normal. There was good light perception and projection in all quadrants. Visualization of the vascular tree was good. The fundi were not seen. Under homatropine cycloplegia both lenses were found to be completely opaque. The fundi could not be seen.

An extracapsular extraction was performed on the left eye on August 12, 1939. There was a small hemorrhage in the anterior chamber at the time of operation. The postoperative course was more or less uneventful with gradual absorption of the blood from the anterior chamber. On October 17, 1939, the patient complained of severe pain and redness in right eye. There was circumcorneal injection; the tension was found to be R.E. 36.5 mm. Hg; L.E., 18.5. On November 26, 1939, numerous deposits were seen on the posterior surface of the cornea of the right eye. The tension dropped to 33.5 mm. Hg under pilocarpine and eserine drops.

The patient was readmitted to the hospital on November 28, 1939. The cornea of the right eye was steamy, and a few deposits were found on the posterior surface of the cornea of the left eye. Tension in the right eye was still 35 mm. Typhoid therapy was followed by moderate improvement. Atropine sulphate 1 percent was given. Tension was reduced to 25.0 mm., and there was general improvement.

Since her discharge from the hospital, the right eye has remained injected and the cornea cloudy. She has had to take sedatives for pain. The tension has risen to R.E., 40.0+; L.E., 25.0 mm. Hg. The right eye is still red, the lens is mature. The diabetic condition has been kept under control.

Right hydrophthalmus

Dr. Roosevelt Brooks presented a white girl, who was referred to the Eye Clinic on December 9, 1939, by the Department of Dermatology. Vision in the right eye had been poor all her life. Her father stated that she had an attack of measles at the age of five months which was followed by redness and inflammation of the right eye.

Vision, R.E., was the ability to count fingers at 1 foot; L.E., 1.2 — 2. The right eye converged 25 degrees, and there was limitation of motion. The right eyeball was much larger than the left, the cornea measuring 13 by 15 mm.; the pupil was smaller than that of the left eye, but both reacted to light. There was a faint line of opacity in the lower limbus.

The fundus showed cupping of the disc, with vessels disappearing at the margin. The central portion of the disc was pale, the pallor extending to the temporal margin. The only normal nerve tissue was found nasally above and below. The vitreous was fluid and contained many threadlike floaters. The tension R.E. was 35 mm. Hg; L.E., 20. Pilocarpine 2 percent was ordered three times a day in the right eye. The peripheral fields were taken and showed irregular contraction for the right eye.

On February 3, 1940, the tension was R.E., 22.5; L.E., 16 mm. Hg. The pupils

were 1.5 mm. in diameter.

Tension on March 16, 1940, was R.E. 25; L.E., 20. Prior to this reading the patient had run out of medicine and the tension showed a prompt increase.

Disciform degeneration of the macula

Dr. Carl Apple presented C. E. P., first seen in July, 1938, with a history that vision in the right eye had been blurred during the past seven months. There was gradual development of pain at times in this eye. Corrected vision was R.E., 0.8; L.E., 1.5. Both discs had a motheaten appearance, the degeneration completely surrounding the disc of the left eye, and around the lower border of the disc of the right eye. No macular pathology was found.

In August, 1939, the patient returned with vision R.E., 0.1. In the macula was found a one-fifth p.d. homogeneous area elevated about 2 D.; surrounding this was a crescentic exudative ring, heaviest at the lower aspect. At the lower inner margin of the central area was an ill-defined extravasate of blood. The retinal blood vessels stretched across uninterruptedly.

The condition must be differentiated from a malignant melanoma. Verhoeff states that a malignant melanoma in the macula clearly resembling disciform degeneration seldom occurs, and he advises watchful waiting before enucleating the eye.

Hole in the macula

Dr. Carl Apple said that J. S., aged 48 years, gave a history of being struck in the eye with an apple; since then the vision in the left eye had been greatly impaired. Vision R.E. was 0.5−4; L.E. 0.1.

A one-sixth p.d. circular light-yellowish-gray area was seen, surrounded by a rim of pigment. The disc of the left eye was surrounded by an irregular fringe of heavy black pigment ranging from 0.5 to 2 p.d. in extent. The pigment was heaviest in the upper half. Some light areas were interposed in the pigment. The retinal blood vessels stretched across, being interrupted in only a few spots.

Bilateral congenital coloboma of iris and choroid

Dr. Martha Rubin Folk said that E. V., aged 44 years, came to the Research Hospital in September, 1939, giving a history of "bad eyes" since birth. About three years ago vision in the left eye began to fail and became progressively worse.

Corrected vision R.E. was 0.2; with glasses, 0.6. In the left eye vision sufficed only for light perception; extraocular movements were normal.

The right eye showed coloboma of the iris, pear-shaped, with the apex pointing downward. A small bridge of iris was present about 2 mm. below the lower border of the iris. The lens presented a small, pinpoint, knob-shaped, grayish opacity in the posterior cortex of the lower border at the 6-o'clock position. The disc was normal. About 2 p.d. below the disc was a large, round coloboma several p.d. in size and 3 D. deep; it was brilliant white in hue and sharply defined, somewhat deeper than the adjoining portion of fundus. The upper edge of the coloboma was bordered by pigment. The retinal vessels displayed an irregular course. Fields showed a scotoma corresponding to coloboma.

The left eye presented a coloboma of iris similar to that in the right. The lens was opaque and the slitlamp revealed an anterior grayish opacity of the cortex and a posterior golden-brown opacity of the nucleus. The fundus could not be seen.

In this case there was an incipient

cataract of the right eye and a mature cataract of the left eye. Cataracts in these cases are usually complicated.

Congenital coloboma

Dr. Martha Rubin Folk said C. L., a girl aged seven years, was first seen at the Illinois Research Hospital on March 15, 1939. The mother stated that the child's pupils have been distorted since birth.

The findings were R.E.: divergence of 10 degrees for distance. The cornea measured 11 mm. in diameter and was somewhat oval shaped. The irides were dark brown. The coloboma of the iris was directly downward at the 6-o'clock position. In the left eye a small border of peripheral iris tissue was visible but none in the right eye. The pupils were key shaped, and reacted to light and accommodation. The coloboma of the choroid of the fundus in the right eye covered the lower quadrant and continued in the lower parts of the disc and retina. The upper half of the disc was somewhat hazy. The coloboma was several times larger than the disc diameter, whitish in hue, and deep. There was a faint pigment bordering the coloboma.

A similar coloboma somewhat smaller in size was found in the fundus of the left eye about 1 p.d. below the disc.

Vision unaided in the right eye was 0.5 + 2; in the left eye, 0.5 − 2.

Congenital anomaly of lid and corneoconjunctival dermoid

Dr. Martha Rubin Folk said that M. W., aged 56 years, was seen at Illinois Research Hospital in October, 1937, complaining of a growth on the conjunctiva and a defect on the upper lid. It had been noticed that the tumor was encroaching on the cornea.

A similar tumor was removed when the patient was six months of age. It recurred shortly afterward, but only recently had the patient noticed an increase in its size.

The left upper lid presented a coloboma, triangular in shape, the base corresponding to the lid margin while the apex pointed to the margin of the orbit. A flat growth of solid consistency, 3 by 4 mm. in size, encroached on the cornea between the 3- and 5-o'clock positions. This was situated partly on the conjunctiva and partly on the cornea on the temporal side, to which it was immovably connected. The tumor was yellowish-white in color. The fundi presented moderate arteriosclerotic changes of the retinal vessels.

Vision R.E. was 0.6; L.E., 0.8.

Slitlamp examination of both lenses revealed homogeneous reddish-brown posterior cortical opacities which extended toward the nucleus between the 1- and 2-o'clock positions.

This patient has been under observation for two years and no increase in the size of the tumor has been noted. There is no hair to cause irritation. Surgical treatment has been deferred until there is increase in the size of the tumor.

On the hypofunction of the lacrimal gland

Dr. Andrew deRoetth presented a paper on this subject which has been published in this Journal (January, 1941).

Discussion. Dr. Sanford Gifford said that the closing of the tear points was first proposed by Beetham with the idea that when patients have such a lack of lacrimation, it does no harm to close the tear points because they will not run over anyway. As long as the conjunctiva is not irritated nor dried with astringents, the patients get along well with a simple substitute for tears. As soon as they stop using drops their lacrimal function is as low as ever. The gelatin solution was proposed by Rucker of the Mayo Clinic,

and a preservative was added because of the tendency to deteriorate and become moldy.

In Dr. Puntenney's series, four would be easily recognized as keratoconjunctivitis siccas. The others were, as Dr. Roetth said, mild cases which had been diagnosed as chronic conjunctivitis and treated by astringents and other medication elsewhere.

THE LIMITS OF TYNDALLIMETRY IN THE ANTERIOR CHAMBER

DR. PETER C. KRONFELD presented a paper on this subject which has been published in this Journal (January, 1941).

Discussion. Dr. Robert von der Heydt congratulated Dr. Kronfeld not alone on the work, but on the opportunity he had to do this research in China. Roenne described the colloidometer three years ago and based his observations on the results obtained in the three previous years during which he had used it. Vogt had described the normal aqueous as empty or void. Personally, in abnormal conditions, he spoke of "the visibility of the beam."

Dr. Von der Heydt had expected to try out this Zeiss colloidometer in the clinic and for a year and a half looked for cases in which to use it. It was surprising how few were found which would allow of continued observation. One not only needs a hospital and unlimited material but continuous opportunity to observe by this method. He had to content himself with clinically designating this tyndall as a faint visibility of the beam, visibility of the beam, or a marked visibility of the beam, depending on his opinion at the time.

Roenne, after using the colloidometer for three years, came to the conclusion that marked visibility of the beam excludes a tuberculous etiology. These cases of cyclitis that immediately start with visibility of the beam are not supposedly tuberculous. During years of slitlamp observation he had seen early cases of iridocyclitis, and found almost half to start with marked visibility of the beam and no cells. It may be that the cells are invisible in this mass of albumen. These are usually cases of cyclitis. Most cases of iridocyclitis start with a leukocytosis and lymphocytosis and hardly any or a faint tyndall phenomena. Also, many instances had been seen where there was an early blizzardlike storm of leukocytes in the convection current of the anterior chamber. There could not have been much in the way of colloids or albumen in addition to the cells. There is no question but that one type of iridocyclitis starts with cells and one with tyndall phenomena. Whether one is more often tuberculous it is hard to say. Tyndall phenomena were found in two other conditions, one in fresh retinal detachments and the other in a reactivation of old choroiditic foci without anterior manifestations.

Dr. John Bellows said that the specific gravity, which is another index of changes in the protein content of the aqueous, fluctuates after a paracentesis. This may offer an explanation for the discrepancies between the readings obtained by colloidometry and the chemical determinations. Thus, if the interval elapsing between observation with the slitlamp and the aspiration of the aqueous should vary greatly, there will be an appreciable change in the colloid content during this time.

Dr. M. Goldenburg remarked that while it may not be a comparable test, would not a photoelectric cell, which would not depend upon the visual capability of the observer, be more accurate, and could it be applied? For example, in the various blood tests that are made for sugar, nonprotein nitrogen, and urea, in which a colorimeter is used, the newer

instrument used for this purpose depends on the photoelectric cell and is practical. Relative to protein in the aqueous, there are so many factors involved in the normal that it would be difficult to say what is normal and what is not until much data had been accumulated.

Dr. Peter C. Kronfeld, in closing, said that he was very grateful to Dr. Von der Heydt for his comments. The chief reason why we sometimes recognize the normal protein content as a faint beam and in other cases miss a protein content of 100 mg. percent or more is that there are different optical conditions. We recognize the normal protein content only under optimal optical conditions. In this series the conditions were not optimal and therefore unfavorable for detection of a faint beam. He was convinced that the normal aqueous under optimal conditions gives a positive beam.

With regard to Dr. Bellow's comment, by applying the contact glass and determining how strong the tyndall effect of the cornea was, it was shown almost conclusively that the discrepancy between the colloidometric readings and the respective protein contents was chiefly due to the fact that the cornea was more luminescent than normal. The interval between the colloidometric reading and the withdrawal of the aqueous was usually five minutes. The patient with chronic uveitis referred to in table 2 was watched for long periods; her colloidometric readings were taken many times and found to vary but little.

Dr. Goldenburg suggests the use of the photoelectric cell for tyndallimetry in the anterior chamber—a splendid idea—but he did not know of any efforts having been made to materialize this suggestion. Dr. Goldenburg's comment about the scantiness of knowledge of the protein content of the normal aqueous is very much to the point.

With his associates in China he had made a systematic study of this subject, the results of which have been published (Trans. Amer. Ophth. Soc., 1940). At the present time it is probably safe to consider a protein content of 30 mg. percent as the upper limit of normal.

Report of five cases of Van der Hoeve's syndrome in one family (three generations)

Dr. Philip M. Corboy presented a paper on this subject which has been published in this Journal (January, 1941).

Discussion. Dr. Peter C. Kronfeld felt that Dr. Corboy had covered the subject so completely and thoroughly that no significant contribution could be added. There is a controversy in Europe as to whether the syndrome should be called Van der Hoeve's syndrome. Rose (Arch. f. Ophth., 1939, v. 140) contends that Adair-Dighton deserves the credit for recognizing this triad. In looking over that report he agreed with Dr. Corboy in that it had hardly dawned upon Adair-Dighton that there was any connection between otosclerosis and the other two conditions; namely, brittle bones and blue sclerotics.

It seems that there is a method by which one might determine why these sclerae let the uvea shine through; namely, the roentgen absorption spectrum introduced into ophthalmology by Hertel some years ago.

Dr. Corboy brought up the question of therapy. From the orthopedic literature it seems that the authorities in this field have given up hope of ever discovering the adequate form of therapy for this disease. It does not fit in with any of the well-known forms of parathyroid disturbance. Dr. Corboy's patient had low calcium and low phosphorus, but there have been many cases with normal calcium and phosphorus content of the blood showing Van der Hoeve's syn-

drome. Arcus juvenilis seems to occur frequently in patients with Van der Hoeve's syndrome. Apparently Dr. Corboy's patients had it, and that might be significant. The question of the treatment has been solved by the new regime in Germany. This disease represents what the law calls a serious physical malformation that is definitely hereditary. The poor woman for whom Dr. Corboy is now considering pushing vitamins and calcium would not have any chance of escaping sterilization in Germany.

Dr. Philip M. Corboy, in closing, said that this child would be closely studied in the next few months from the standpoint of therapy. Normal calcium determinations were found in this case, but the trend has been toward low calcium and low phosphorus.

In reply to Dr. Kronfeld's statement "that many of these cases have normal calcium and phosphorus" the literature bears this out clearly—but the four cases reported here were definitely low in these elements.

Robert von der Heydt.

COLORADO OPHTHALMOLOGICAL SOCIETY

March 16, 1940

Dr. Melville Black, *presiding*

Some principles of ophthalmic surgery

Dr. Parker Heath of Detroit gave the address of the evening on this topic. He discussed the importance of gathering complete preoperative data involving the state of the general health as well as the specific ocular situation. Some positive criteria that call for surgical interference in ocular diseases were pointed out. The type of operation selected for a certain condition should be carefully considered.

Dr. Heath made a plea to the ophthalmic surgeon for the continuance of training in surgery throughout his active life. "This" he said, "is done through animal and cadaver surgery; studies in physiology; familiarity with different instruments; minute descriptions and records of each physical procedure; exposing himself to criticism and correction by demonstrating his own work and visiting other clinics; and honest note taking and reporting through the medium of medical societies."

Bilateral subluxation of lenses

Drs. Charles Walker, Jr., and Horace Weston presented the case of L. W., an eight-year-old girl. When first seen both lenses were dislocated up and nasally. With a correction for myopic astigmatism the vision was 20/200 in each eye. The aphakic areas could not be corrected unless the pupils were dilated. An attempt to needle the lens of the left eye induced no absorption. In December, 1938, an intracapsular lens extraction was done on the left eye, the incision being made inferiorly. Considerable traction was necessary to break the zonule. In November, 1939, an extracapsular extraction was done on the right eye, also from below. In both cases the iris curled upon itself inferiorly to give the appearance of a coloboma, although no iris tissue was removed. No vitreous was lost at either operation. The corrected vision is slightly better than 0.5 in each eye.

Discussion. Dr. Parker Heath stated that most patients with subluxated lenses should be operated upon as, otherwise, many subsequently develop glaucoma.

Band keratitis and uveitis in polyarthritis

Drs. William Bane and Robert Sherwood presented D. L., an eight-year-old girl with Still's disease. At the age of

two years this child developed arthritis and lost the sight of the right eye through uveitis and cataracta complicata. There has been a gradual increase in the arthritic manifestations and there has also been a chronic uveitis in the left eye. At this time the right eye is divergent. There is a band-shaped opacity of both corneae involving the lower pupillary zone. This band does not stain with fluorescein. There are numerous posterior synechiae and the lens of the right eye is cataractous. The vision of the right eye is questionable light perception and of the left eye it is 0.6—. There is marked ankylosis of the spine, fingers, and feet. The pathology of band keratitis was discussed.

Retinal detachment

Drs. William Bane and Horace Weston presented Mrs. N. F., aged 47 years, who had developed blurred nasal vision in the left eye two months previously. The temporal retina was found to be separated and a semilunar tear was seen in the upper temporal quadrant. The patient had received a severe blow to the head two years previously but no recent trauma. The refraction of the affected eye was -1.00 D.sph. $\bigcirc\!\!\!\!\sim$ -4.00 D.cyl. The patient is now wearing pupil glasses and prompt surgery is planned.

Discussion. Dr. Parker Heath discussed the relationship of trauma to retinal detachment, stating that in any specific case it is very difficult to prove positively that trauma is a factor and that, at best, one can give only his impressions. Often, in the truly traumatic cases, there are subjective symptoms, such as sparks and dazzling, shortly after the injury. The underlying cause of most detachment is probably a disturbance in the choriocapillaris.

Juvenile macular degeneration

Dr. D. H. O'Rourke presented a man, aged 43 years, who had consulted him because of defective vision. The patient had never seen well but vision had decreased considerably during childhood. When examined, the vision was found to be slightly less than 0.1 in each eye. Both eyes were entirely normal except for the macular areas. There was circumscribed pigment deposition and absorption in both maculae. The choroidal vessels could be seen fairly well in these areas. In view of the history and present appearance, a diagnosis of juvenile macular degeneration was made. A family history was unobtainable, as the patient has had no contact with his family for many years.

Dr. O'Rourke also reported a similar case. A boy, 15 years old, consulted him because of progressive visual loss. No fundus lesion could be seen at that time, but within a few months a definite macular degeneration was apparent. When he was 18 years old a drawing of the eyes was made for Wilmer's Atlas as an example of juvenile macular degeneration. The father of this patient gave a similar visual history.

Uveitis with glaucoma

Drs. William M. Bane and Horace Weston presented Mrs. P. R., aged 35 years. When first seen on February 3, 1940, there was bilateral circumcorneal injection and the tension of each eye was 35 mm. Hg, Schiötz. There were keratitic precipitates on the lower third of the posterior corneal surface of the right eye. The tension dropped a little under homatropine and then rose again, 10 days later, to its previous level. The patient has had several intravenous injections of typhoid "H" antigen. A corneal paracentesis has been done three times on the right eye and once on the left. The tension is now 35 mm. in each eye, and there has been no definite improvement in the

uveitis. The general examination, including Wassermann and tuberculin tests, was negative. Dr. Bane stated that unless rather definite improvement occurred soon, some surgery would be done.

Discussion. Dr. Parker Heath stated that, in his experience, such diseases were best controlled by iridectomy, particularly if the surgery could be done during a quiescent interval. In such a case surgery may be postponed unless the glaucoma is producing a visual-field loss.

John Chenault Long,
Secretary.

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

SECTION ON OPHTHALMOLOGY

March 15, 1940

DR. HENDRIE W. GRANT, *presiding*

STUDIES ON RETINAL ADAPTATION IN VITAMIN-A DEFICIENCY

DR. H. L. BAIR, Rochester, gave his inaugural thesis on this subject. Lantern slides were shown.

SOME EFFECTS OF OPERATIVE WINDOWS ON SINUS PATHOLOGY

DR. ANDERSON HILDING, Duluth, gave a talk on this subject. Lantern slides were shown.

Discussion. Dr. John C. Brown, St. Paul, said that he admired Dr. Hilding's approach to and ideas on this subject and pointed out that there are a number of factors in connection with this subject that he has mentioned; for example, about the lower animals' having different drainage and perhaps different mechanism. In the long-nose animals, such as the horse or any of the ruminants belonging to this group, or rodents, the fifth nerve has a second branch that goes directly forward. In these animals the fifth-nerve second division runs almost directly forward and carries its canal to the maxillary sinus. It is pointed out in the large orbit, and as can be seen in specimens or pictures, the molar teeth in the rabbit push up so that the sinus runs quite far forward. This section on the rabbit is very successful.

Dr. Anderson Hilding said that he had said nothing about the complete removal of the lining of the sinuses. That is a different proposition. This deals only with windows. He does not think that enlargement of the frontal ostium can be done with impunity or that the ethmoid sinus can be torn out with impunity.

THE ROUTINE TESTING OF OCULAR MUSCLES—AN EVALUATION OF THE METHODS

DR. WALTER H. FINK, Minneapolis, presented this subject illustrated by lantern slides.

Discussion. Dr. R. William Morsman, Hibbing, said he had been working along the same lines for the last two years and could bear out Dr. Fink's conclusions to a large extent. He found that symptoms relative to imbalance are much better correlated and the results are much better when tested with the rotoscope than by the older method. During the past two years, he had given patients with uncorrected symptoms a certain amount of training on the rotoscope, making perhaps 100 experiments. If physical and laboratory examinations were negative, he had patients come back and put them on exercises to develop a normal field of muscular activity with a certain amount of reserve power, which can be developed, and in many cases rather easily. He had made a hobby of this study in the last

two years, and in his opinion refractionists have overlooked an opportunity to give relief by this sort of treatment and thereby not only give satisfaction but prevent certain patients from making the rounds among us, saying this doctor does not know how to fit glasses, and so forth. His theory in giving these exercises is that we create new or stimulate normal fields of function. We have to have a certain amount of reserve. We are on the way to giving comfort in the refractions of the asthenopic.

Dr. H. L. Bair, of Rochester, asked: "How valuable are those peripheral stimuli?"

Dr. Walter H. Fink, in answering, said, "Three years ago I had occasion to look into the matter of peripheral fusion in detail and obtained a fairly good knowledge of the literature on the subject and, in addition, did some experimental work. I came to the conclusion that peripheral fusion has a definite value, perimacular fusion, however, being of greater importance.

"I have used the rotoscope for several years and I believe that it brings to light certain phases of the muscle problem that you cannot obtain on the phorometer. Stereoscopic vision can be employed on the rotoscope, and it is of definite value in determining the degree of ocular coordination. It would be of great value to determine not only the presence of stereoscopic vision, but also the degree. It seems to me that patients who have a high degree of stereoscopic vision have far more ocular reserve power."

George McGeary,
Secretary-Treasurer.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

March 19, 1940

DR. J. HERBERT WAITE, *presiding*

OCULAR BRUCELLOSIS

Dr. E. L. BURKY (Johns Hopkins Hospital, Baltimore) read an interesting paper on this subject. He said that Brucella (species undertermined) has been recovered from the milk, blood, spleens, and lymph glands of six mares killed because of blindness due to clinical periodic ophthalmia. This is a recurring iritis or uveitis with all the clinical features and sequelae observed in this condition as it appears in the human.

When injected into the anterior chamber of rabbits, or intravenously into rabbits and guinea pigs, the first strain that was recovered produced in some but not in all animals ocular inflammation resembling periodic ophthalmia in horses and chronic recurrent ocular inflammation in the human.

After these rather striking experimental results had been obtained in animals, an investigation was begun to determine whether this bacterial genus could cause human eye diseases. Fifteen cases in which there was some evidence of this infection had been studied. The evidence is based on four tests: 1. Complement fixations with Brucellin as an antigen. 2. Opsonocytophagic tests with living cultures as an antigen. 3. Agglutination tests with the same antigens. 4. Cutaneous reactions to Brucellin.

The ocular lesions observed included recurring keratitis, iritis, and keratoiritis, and tuberculouslike lesions in the fundus.

Virgil G. Gasten,
Recorder.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

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FUNDUS REFLEXES

Reflections of light from the fundus of the eye are familiar to those who make much use of the ophthalmoscope. If one sits in a partly lighted room, facing a window at twilight, he will see a mixed picture. Things outside in the waning light will be confused with things in the room seen by the indoor light and reflected by the glass of the window. As the daylight wanes, the reflection from the window of things inside becomes more distinct. Something similar to this occurs when we look at the fundus of the eye with the ophthalmoscope.

Various parts of the retina, choroid, and sclera, and pathologic changes in them, are made visible. But one may also see reflections of the light thrown into the eye from the surfaces of certain glass membranes. The internal limiting and external membranes of the retina, and the transparent membrane on the surface of the choroid may take part in such reflections. In an albino eye none of these reflexes may be noticed. But in the darkly pigmented brunette eye of a young person they may be most striking. In some deeply pigmented eyes these retinal reflexes are the feature of the fundus picture that first attracts attention. They are most noticeable in young eyes with perfectly clear media.

By turning the ophthalmoscopic mirror the light is made to fall on the eye in a different direction; and the reflexes may

be changed in shape and direction. They vary so greatly in different eyes, that they are worth careful study. Normal reflexes may be sometimes taken as evidence of pathological conditions, unless they are recognized for what they are.

For his address as president of the Section of Ophthalmology of the Royal Society of Medicine, Dr. A. J. Ballantyne took for his subject, "The reflexes of the fundus oculi." In his published address he has illustrated it by 26 pictures of appearances observed. He believes they "deserve more attention than is usually devoted to them." He thinks they may help to an understanding of what may be observed by slitlamp biomicroscopy of the retina.

Line reflexes from the retina may come from traction, raising a ridge of the reflecting surface. Such lines seem to radiate from a scar, involving the choroid and retina, which draws ridges radiating from the center of the lesion. About a progressive lesion they may seem to change from day to day. Information as to how the reflex is produced may be gained when the direction of the light is changed by rotating the ophthalmoscope mirror. The normal reflexes are pretty well shown in books and journal articles giving pictures of the normal fundus. But the different appearances are all better studied by looking into the eye through the ophthalmoscope, rotated to shift the direction of the light falling on the retina. Fixed exudates do not change with the rotating of the mirror. Edward Jackson.

OCULAR RHEUMATISM

This title may provoke a smile in ophthalmologists who twenty-five or thirty years ago discarded similar expressions as misleading and unscientific. For many years the term "rheumatism" has been much discredited, because it was thought of as a cloak for ignorance concerning the causation of obscure inflammatory processes. Yet it is still widely used by the laity and even by physicians, especially in connection with the malady known as arthritis deformans.

The word "rheumatism" comes to us from a Greek verb meaning "to run," "rheum" having originally implied a running at the nose or eyes—in other words a common "cold in the head" or a condition superficially resembling it.

Since the development of bacteriology it has been a rather general custom to deride the use of the word "cold" in this connection. At the present time there is, however, some evidence of a disposition to believe that our ancestors were not altogether foolish in attaching great importance to temperature changes in the production of certain bodily ailments.

The earlier vague reference to unexplained forms of sluggish uveitis as "rheumatic" fell out of fashion as we learned the importance of focal infection in the production of ocular inflammation. There were many teeth whose nerves had been killed by deep local infection, and many whose nerves were wantonly destroyed by the dentists of a less enlightened generation in order to render painless the fitting of crowns and bridges. Most dentists of today have agreed to avoid this dangerous practice, and the crop of eye infections from dead teeth is much lighter than it was even twenty years ago.

The very general attribution of a certain sluggish type of anterior uveitis to miscellaneous focal infections is peculiarly American. For a long time this view was regarded with disfavor in Germany, where the majority of such cases were interpreted as tuberculous.

Many of us still speak rather habitually of "Koeppe nodules," and associate with such tiny granulomata an implication that

the underlying infection is tuberculous. Some of us have rather enjoyed the experience of seeing these nodules disappear promptly upon removal of such sources of focal infection as diseased teeth or tonsils; although we were gravely assured that this circumstance did not disprove an underlying tuberculosis but merely demonstrated that removal of one source of infection might enable the body to fight successfully against the simultaneous activity of another bacterial invader.

In cases whose chronicity or sluggishness in spite of treatment suggests a focal origin, it is by no means always possible to discover a cause whose removal leads to cure. A bewildering succession of investigations, followed one after the other by surgical interference with teeth, tonsils, and nasal sinuses, or attempts to deal with infections in other parts of the body, may reduce physician and patient alike to a sense of hopelessness. We may be lucky enough to achieve a temporary gain by the use of a foreign protein, only to experience a later relapse or a new attack. As a confession of, and a cover for, our ignorance in such cases, the old term "rheumatism" is probably just as effective and excusable as it ever was.

Marchesani (Klinische Monatsblätter für Augenheilkunde, 1941, volume 106, page 1) points out the folly of assuming that a nodule in the iris, or a focal arrangement of the inflammatory reaction, is necessarily an expression of tuberculosis. He quotes Davids (his associate at the Münster clinic) as having demonstrated that nodular foci of inflammation in the eye may rest anatomically upon a variety of bases (nonspecific collections of lymphocytes, bacterial concentrations, and so on), and may have a quite variable etiology. In rheumatism as it is encountered outside the eye, tuberclelike granulomata are a typical form of tissue reaction.

In a general way, Rössle regards the formation of granulomata as the expression of an "allergic-hyperergic process" and he holds the "specific" granulomata of the infectious diseases to be an allergic form of inflammation. Aschoff demonstrated miliary nodules in the heart muscle in rheumatic fever, and such nodules have also been found in the periarticular tissue of the joints and in numerous other tissues. Klinge and others have shown them to be present in chronic articular and muscular rheumatism.

Rössle (Klinische Wochenschrift, 1936, volume 15, June 6, page 809) conceives rheumatism as the "expression of a reaction of the body or its tissues to variations in immunity and leading to an allergic-hyperergic readiness for inflammation." The histologic changes in rheumatic tissues, while varying greatly with locality and structure of the affected organ, are described as follows: The characteristic of the first stage is a fibrinoid cloudy swelling and disintegration of the mesenchymal elements. In the sclera and cornea the foci resemble those found in tendinous or ligamentous tissues of the rest of the body. In the uvea the connective-tissue cells, including the chromatophores and the cells of the vessel walls, take part in the reaction. In later stages there is increased proliferation of various cellular elements (especially histiocytes and giant cells) surrounded by accumulations of round cells. The pigment epithelium takes part in the defensive reaction, with the addition of epithelioid cells. Such signs of rheumatic inflammation were found by Marchesani in eyes enucleated on account of chronic uveitis.

By those who have not fully admitted the significance of focal infections, it is sometimes argued that chronic tonsillitis and other foci are very frequent, whereas only a few of the individuals thus affected develop a uveitis. But the presence of

such foci is relatively much more common in the patients suffering from uveitis than among the rest of the population.

Marchesani points out that the newer understanding of the basis of "rheumatic" infection provides an explanation why this class of ailment develops among some and not among other carriers of infective foci. A prerequisite for the devolopment of a generalized disturbance in the "rheumatic" sense is the existence of an allergic tendency such as does not occur in all subjects.

It is now pretty generally understood that the most significant factor in an allergic patient is not the fact, however disagreeable it may be, that he reacts in an exaggerated fashion to some particular subsance or influence, but that constitutionally he possesses such a general capacity for exaggerated reaction as is not displayed by most people. It is probable that this tendency is hereditary in some families, although it may perhaps be acquired as the result of prolonged infection such as infantile tuberculosis. Sylla characterizes tuberculosis as the "most frequently allergizing disease."

From this point of view, uveitis and comparable inflammatory processes in other parts of the eye are only localized forms of the general pathologic consequences of a focal infection. Chronic rheumatism of the joints or muscles, as well as "rheumatic" disease of the heart and blood vessels, are to be considered as analogous disorders. But it must be borne in mind that a "rheumatic" iritis may apparently exist without rheumatism of a general character.

An interesting detail with regard to Marchesani's paper is an occasional reference to the influence of reduced environmental temperature in the production of "rheumatic" disturbances, including uveitis and other ocular affections. Marchesani definitely recognizes the influence of simple chilling as an exciting cause of uveitis. According to Hallermann, the decisive element in this connection is apparently an exaggerated vasomotor reaction. It is suggested that in the eye the climatic factor may be effective through chilling of the anterior segment or through reflex vasomotor reactions in the region of the anterior ciliary vessels. Vaubel is quoted by Marchesani as having caused allergic inflammation in the joints and muscles of sensitized lower animals by the application of cold.

This whole field of thought lends itself, almost endlessly, to speculative reflection. Allergic phenomena may be considered as representing immunologic reactions. But also in the nature of an immunologic reaction is the fever produced by administration of a foreign protein. Thus, in many of our cases of uveitis we are probably employing one type of immunologic reaction to combat the deleterious effect of a second such type. Would it be possible to apply this principle to the care of other allergic phenomona? W. H. Crisp.

EXPANSION OF ANISEIKONIC CLINICS

The purpose of this editorial is to discuss the merits of greatly increasing the number of aniseikonia stations; a plan that is now being undertaken throughout the United States.

It would not be feasible to consider the theory of the correction of aniseikonia here. Its existence has been recognized at least since 1864. The accuracy of its measurement by the ophthalmo-eikonometer, insofar as it goes, is generally accepted, although there are some who think that phorias instead of aniseikonia are being measured. The examination is not complete in that the aniseikonia can be measured by most of the instruments at

axes 90 and 180 degrees only, and even if it were possible to measure the aniseikonia of the oblique angles this cannot at present be prescribed in the patient's lenses, but only the overall correction or that at 90 or 180 degrees can be incorporated in the glasses.

The most mooted question, however, is the importance of aniseikonia in the comfort of the patient. Those who believe that image size can have little to do with this point out that no muscles are involved, hence muscle fatigue is eliminated and only the nerve confusion arising from unequal retinal images could possibly be responsible for the patient's symptoms if aniseikonia is the source of the difficulty; that the condition must always have been present in the individual but for many years without causing symptoms; and, lastly, that it occurs frequently in every individual when the object under observation is unequally distant from the two eyes. This last objection was advanced by Ludvigh in a paper published in this Journal (Amer. Jour. Ophth., 1936, v. 19, p. 292). The following year Herzau and Ogle (Arch. f. Ophth., 1937, v. 137, p. 327) showed, however, that the eye seems to compensate for aniseikonia occasioned by asymmetrical convergence.

Since study of the theory does not answer the question clearly, it seems that we must turn to clinical results in attempting an explanation, but, unfortunately, there is no reliability in them, since by elimination the typical patient submitting himself for aniseikonia is the neurasthenic who has tried every other conceivable eye test without success and hence is the most difficult possible patient to satisfy but, on the other hand, is the patient most amenable to suggestion. Naturally, not all subjects are of this temperament, but in general the aniseikonia clinics have received the impossible patients whom the ophthalmologists have been glad to see try anything, if only to give them a short respite from the unsatisfied patient.

The first question that naturally arises is whether adequate clinical controls have been made; in other words, has a large group of supposedly normal, ocularly symptomless subjects been compared as to their aniseikonia with a group of those with symptoms suggestive of aniseikonia. This was done by the Dartmouth Clinic before any instruments were released as well as later, and it has been found that though aniseikonia did occur in the control group it averaged much less than in the group with symptoms. The general average in the control group of 459 was one third of one percent whereas that of a group of 354 selected at random from clinic files was one percent. A second type of control tried out fairly often has been that of changing the eikonic lens from the true correction without the knowledge of the patient. Practically invariably the patient has had a quick return of symptoms, relieved by again installing the correction.

A second question the answer to which might greatly modify the clinical results of aniseikonia correction is as to whether there has been a considerable change made in the underlying prescription for lenses at a time when the eikonic lens was ordered. Obviously, if such a change was made this might be responsible for any benefit from the new lenses which also incorporate correction of the size difference. From personal experience no radical change has been made in about 90 percent of our aniseikonia patients. Most of those who have consulted our clinic have already had excellent refraction elsewhere and such changes as have been made were usually insignificant. In many cases there has been no change whatever in the fundamental glass.

Turning now to the three reports comprising the largest numbers of patients, we find a considerable similarity in re-

sults. Hughes reported in 191 patients receiving aniseikonic correction complete relief in 46.6 percent; marked relief in 26.2 percent; no relief in 24.5 percent; slight relief in 2.7 percent, totaling relief of some degree in 75.5 percent (Amer. Jour. Ophth., 1937, v. 20, p. 887). At Dartmouth, of 500 patients receiving the correction 283 (57 percent) obtained definite relief from ocular or general symptoms (Carleton and Madigan. Arch. of Ophth., 1937, v. 18, p. 237). Berens found in 368 hospital patients that 51.8 percent obtained some relief (Amer. Jour. Ophth., 1939, v. 22, p. 625).

In the Washington University Clinic, 131 patients replied to a questionnaire as follows:

	No.	%	
Very satisfactory	53	40.6	72.7
Moderately satisfactory	42	32.1	
Unsatisfactory	36	27.3	

Of the 36 patients with unsatisfactory results, 15 had been satisfied with the temporary glass, but when the eikonic correction was combined with the patient's own lens the new lenses were no longer comfortable.

Contact with many of the several hundred patients who have been examined in the Washington University Clinic in the past seven years has led to belief that undoubtedly something definitely helpful has been done for many of these patients. But has it been the correction of aniseikonia? That this aid could be entirely psychological seems improbable. There has been no supersalesmanship. The patients are all seen by an ophthalmologist, though the actual manipulation of the ophthalmo-eikonometer has been performed by a technician for the last three years. The patients are told that the question of aniseikonia is still in the experimental stage and that possibly its correction, if any is advised, will not prove helpful but that it is worth trying. No effort is made in any case to persuade the patient that he will be helped. It does seem unlikely that from this background 72 percent would find satisfaction on a psychological basis.

Clinical evidence is, however, at best unreliable, depending, as it does, on so many factors. The worker in aniseikonia can recall many remarkable successes but also many failures that seemingly, if aniseikonia were the cause of the trouble, should have been successes. A report from those who had had corrections prescribed five or more years previously might be illuminating. Merely the fact that patients have obtained temporary relief is no argument for aniseikonia nor is the crowding of the clinics. There are still individuals who are satisfied with "throwing their glasses away" and others who are convinced that they are having their cataracts dissolved by treatments in a small city in Michigan. Americans will buy anything that is well advertised.

To return now to the original question as to what will be the result of increasing the eikonic stations. For one thing it will relieve the pressure on the existing clinics. (At Washington University all appointments are filled for four months in advance.) There will undoubtedly be much grief to those undertaking the work. The examination when properly made is time-consuming and requires much patience. Those needing the examination are individuals difficult to handle. The original investment is high. A technician's training and time are expensive. Ophthalmologists may try to make the examinations themselves but they are apt to give it up, as they do in most cases of orthoptic training if they must do it themselves. Undoubtedly, there will be failures just from such factors as these irrespective of the merits of aniseikonia. Of no small concern to the future of the correction of aniseikonia is the probability that many

new technicians including ophthalmologists may not be up to standard or may be unwilling to devote the time necessary for good work to the study of each patient. The common error is to think that a simple measurement of the aniseikonia is sufficient, whereas the most important consideration is its amplitude, and the estimation of this requires at least several hours. However, it is probably just as well to try this matter out extensively as possible, for we may thereby arrive more quickly at the truth.

Lawrence T. Post.

WAR AND OPHTHALMIC LITERATURE

The disruption of the exchange of medical ideas and literature is among, perhaps, the lesser evils of war. But to the practitioner as well as to the scientist this interruption constitutes a genuine hardship. The discovery of new cures or the invention of new devices may rest unheralded and unsung within the native country. It is not hard to imagine how many citizens of the world would have been affected had the knowledge of the discovery of sulfanilamide been hindered from leaving the country of its origin. The ophthalmologist will recall that it was not until after the last war that the slitlamp and biomicroscope became generally known and available, although it was invented around 1914. Likewise Gonin's work, although begun in 1914, did not become recognized until after peace had been declared for some time, and some of this delay undoubtedly was due to war interference. Many other instances in all the fields of science could likewise be mentioned.

The foreign ophthalmic journals, with the exception of the British Journal of Ophthalmology, are not coming through regularly. Once in a while a German journal makes its appearance. The French and Belgian journals, alas, are no more. The Italian journals are intermittent in their arrival, and so it goes. An occasional monthly issue of this Journal now lies at the bottom of the sea, but when it was suggested to the British librarians that we keep our Journal on this side of the ocean until the end of the war, the word came back "please keep on sending them, it is our only contact with outside science." Foreign subscribers are still on our list although naturally fewer in number, and in a few instances the Journal has to travel by way of Siberia to reach its destination. It is uplifting to the spirit to realize that in spite of the waste, pillage, destruction, and hatred engendered by war, the international flame of science, which knows no race or condition, which recognizes no master save Truth, continues to burn.

The abstract department of this Journal has suffered severely by the hindrance of war, but as long as material arrives it will continue to function, no matter how sparse the material or how few the pages. Every effort will be made to obtain information of what is going on in the ophthalmic world.

During the last war, this Journal survived, although it was necessary to use cheaper paper and fewer pages. There is no reason to believe that it will not survive this time, despite possible rough going. One should pause and pay tribute to the gallant British Journal, somewhat reduced in size, perhaps, but still appearing regularly. The flame may be small but it burns as calmly as ever. It seems unbelievable that men whose lives are interrupted by daily bombings and mental distress should still be able to produce scientific ideas and reports. Their libraries, studies, and wards are anything but quiet. The inner turmoil of their spirits must be overwhelming, and yet the work

goes on. The same conditions must exist on the Continent to some extent at least, although we know so little about them. It is encouraging to think that in all places and in spite of beastliness, hunger, filth, distress, grief, and agony our colleagues are carrying on.

Particularly in this season of the year, waves of nostalgia and pleasant memories of happier days sweep over one. The fragrance of the blossoms recalls the Prater in the Spring; the odor of xylol, the pathologic laboratory in the Krankenhaus; the taste of beer, the Café Klinik; and the light shining through white wine, a Heuriger. To those who have studied ophthalmology in Vienna these things are an intimate part of the subject. To the ex-students of foreign clinics elsewhere similar things have touching meanings.

Whether or not those days will ever recur is beside the point. In the last decade, especially, the ophthalmic clinics of this country have forged to the front, and even before the war a foreign training was coming to be unnecessary. Unnecessary because of the influence of the American Board of Ophthalmology and the societies, as well as the pressure brought to bear on the departments of ophthalmology in our universities. The quality of the teaching of our students and residents, and the quality of the contributions in our journals and transactions have reached the point where we can say with confidence that we have grown up.

We shall always need the world interchange of ideas, not alone for our own scientific growth, but for the benefit and growth of others. Therefore, regardless of the outcome, there will always be ophthalmology and ophthalmic literature.

Derrick Vail.

BOOK NOTICES

THE EXTRAOCULAR MUSCLES. By Luther C. Peter, M.D., LL.D. Third Edition. Clothbound, 368 pages, illustrated. Philadelphia, Lea and Febiger, 1941. Price $4.50.

The subtitle of this book is "A clinical study of normal and abnormal ocular motility," which gives a good indication of the character of the book. The first part devotes 75 pages to the anatomy and physiology. Part two discusses heterophoria, including sections on prisms, relation between accommodation and convergence, muscular dynamics, methods of determining muscle balance, hyperphoria, esophoria, exophoria, and cyclophoria. Part three deals with heterotropia and concomitant squint. Squint operations were an important part of ophthalmic surgery when modern ophthalmology first began to emerge as a special branch of medicine and surgery. But in this account of it appear distinctions and methods of diagnosis that were quite unknown to the surgeons who first undertook squint operations. We find here a very good introduction to the technique of orthoptic training, and its clinical application in practice.

Part four, on paralytic squint, in 61 pages, shows much of the advance of diagnosis and clinical observation on the central nervous system. Part five gives 16 pages to nystagmus, now called talantropia. Part six, surgical technique, will bring the student well abreast of the latest advances in what has been called muscle surgery. Ocular motility is a branch of ophthalmology that has developed rapidly in the hundred years since Dieffenbach did his first operation for convergent squint. It is not fully developed in any of the larger textbooks on ophthalmology; and in many systematic works is some-

what overshadowed by the fuller explanations and broader implications of ocular refraction. This book gives about the best exposition of present knowledge of the subject that has appeared in English, or any other language. It is worthy of the careful study of any ophthalmologist.

Edward Jackson.

CORRESPONDENCE

Skiascopy

May 13, 1941.

Editor American Journal of Ophthalmology:

The editorial by Dr. Jackson on page 579 of the May, 1941, issue of the Journal is of practical interest.

The device to be described has been of use to me routinely for many years. A disc with a pin-point opening in the exact center was selected and the opening was enlarged equally in all radii to a diameter of four millimeters. The trial frame is carefully adjusted so that the center of the pupil will correspond with the center of any trial lens in the cells. After the usual subjective tests have been made the disc with the opening is placed before the trial lenses already in the cells of the frame and tests are repeated with cross cylinders and trial case lenses until final judgment is made. This device requires the patient to use the opening which approximates the size of the visual pupil referred to by Dr. Jackson without sacrifice of the benefits of cycloplegia.

In performing skiascopy the examiner should observe the central area of the dilated pupil and ignore the periphery. Skiascopic examination can be done with the above disc satisfactorily after very little practice.

(Signed) C. W. Rutherford.

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP
ASSISTED BY DR. GEORGE A. FILMER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

1

GENERAL METHODS OF DIAGNOSIS

Blanchard, E. L., and Harper, H. A. **Measurement of vitamin-A status of young adults by the dark-adaptation technique.** Arch. Internal Med., 1940, v. 66, Sept., p. 661.

The authors describe a simple and sensitive test for detecting impaired dark adaptation. Vitamin-A deficiency of ten college students on diets low in vitamin A was studied with this technique. The cases are discussed.

Theodore M. Shapira.

Evans, J. N. **A new scotometer.** Trans. Amer. Ophth. Soc., 1940, v. 38, p. 344.

This relatively simple and inexpensive instrument is constructed to use standard lighting and charts and to conform to standard methods of scotometry now in use. Methods of constructing test objects are described and commercially produced test objects are discussed. David O. Harrington.

2

THERAPEUTICS AND OPERATIONS

Baker, J. P. **Sulfanilamide therapy followed by hemorrhages in the fundus of the eye.** Virginia Med. Monthly, 1940, v. 67, Sept., p. 562.

The author reports the case of a 36-year-old white male who was given a total of 370 grains of sulfanilamide in four days for pyelitis following cystoscopy. His hemoglobin was reduced 20 percent. Blood pressure was normal, vision 20/60 in both eyes. Round hemorrhages were seen along the swollen arterioles. After one month the vision became normal and the hemorrhages disappeared. Theodore M. Shapira.

Bardanzellu, Tommaso. **A new antiseptic for local use in ophthalmology: mercurochrome.** Boll. d'Ocul., 1940, v. 18, Jan., pp. 67-72.

In ulcer of the cornea and in all forms of conjunctivitis, and also as a prophylactic in surgery of the eye and its adnexa, Bardanzellu instills a 4-per-

cent solution of mercurochrome. He believes that mercurochrome is a better antiseptic than many of those commonly used in ophthalmology.

M. Lombardo.

Fronimopoulos, J. **A contribution to cinematography of the eye.** Klin. M. f. Augenh., 1940, v. 105, Sept., p. 356.

For control of the focal distance during cinematography of surgical procedures in ophthalmology, Fronimpoulos uses a metal rod equal to the focal length of the camera lens and attached perpendicularly to the center of a metal disc the diameter of which equals that of the lens mount. With this metallic accessory, not only the focal distance but the centering of the photographic field may be checked. The appliance may be sterilized and used during the course of the operation. F. Herbert Haessler.

Gill, W. D. **A corneoconjunctival knife and a counterpresser for use in eye surgery.** Amer. Jour. Ophth., 1941, v. 24, March, p. 322.

Guyton, J. S. **Local use of sulfanilamide compounds in the eye.** Amer. Jour. Ophth., 1941, v. 24, March, pp. 292-297.

Guyton, J. S., and Woods, A. C. **Advances in the use of sulfanilamide compounds in ophthalmology.** Amer. Jour. Ophth., 1941, v. 24, April, pp. 428-437.

Jahnke, W. **Sterilization of the conjunctiva before intraocular surgery.** Klin. M. f. Augenh., 1940, v. 105, Sept., p. 293.

The author recommends blood-agar plates as the most suitable culture medium for study of the conjunctival flora. When virulent organisms are found, sterilization of the conjunctiva can be accomplished by filling the sac with Schweissinger's yellow eye-ointment and bandaging daily for three days. Where cultures cannot be made, routine prophylactic sterilization is advised. F. Herbert Haessler.

Khluser, G. P. **The properties of platyphyllin, a new mydriatic.** Viestnik Opht., 1940, v. 17, pts. 1-2, p. 57.

A detailed report of an investigation on the pharmacologic properties of this Soviet-manufactured mydriatic. The data show that the preparation produces satisfactory mydriasis without paralyzing accommodation, producing discomfort, injuring the corneal epithelium, or raising intraocular tension. It is inferior to atropine in not producing so wide a mydriasis, in being slower in action, and not separating synechias. It is suitable for mydriasis in glaucomatous patients, and for ophthalmoscopy. Its analgesic action makes it particularly suitable in the treatment of keratitis. Ray K. Daily.

Kluever, H. D., Coughlan, C. H., and Martin, L. M. **The use of burbot-liver oil intramuscularly for ocular avitaminosis A.** Jour. Iowa State Med. Soc., 1940, v. 30, Dec., p. 575.

The authors report cases of night blindness, corneal ulceration, superficial punctate keratitis, early xerophthalmia, and corneal vascularization following cataract extraction, all of which were benefited by burbot-liver oil. Theodore M. Shapira.

Missiroli, G. **Transitory myopia after ingestion of sulfamides, and its pathogenetic interpretation.** Boll. d'Ocul., 1940, v. 18, Jan., pp. 59-66.

Two men and one woman became myopic after the use of sulfamide prep-

arations. The myopia disappeared spontaneously after from five to ten days. The writer believes this change of refraction to be due to a spasm of accommodation. (Bibliography.)

M. Lombardo.

Preobrazschenki, P. B. **Platyphyllin, a new mydriatic.** Viestnik Opht., 1940, v. 17, pts. 1-2, p. 65.

An evaluation of this new mydriatic shows that when instilled into the conjunctival sac it produces a slight and transitory hyperemia and a slight sensation of smarting. It has no effect on the corneal epithelium, lowers intraocular tension, and produces a scarcely noticeable paresis of accommodation lasting five hours. The mydriasis begins in 10 minutes, reaches maximum in from 30 to 45 minutes, and lasts from 20 to 28 hours. The drug is suitable for diagnostic purposes. Pilocarpine contracts the dilated pupil in from 10 to 45 minutes.

Ray K. Daily.

Sverdlow, D. G. **Prothesis for plastic operations.** Viestnik Opht., 1940, v. 17, pts. 1-2, p. 99.

A description of a porcelain prothesis devised by the author. (Illustration.)

Ray K. Daily.

Veasey, C. A., Jr. **Vitamins of the B group and their relation to ophthalmology.** Trans. Amer. Ophth. Soc., 1940, v. 38, p. 538. (See Section 17, Systemic diseases and parasites.)

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Bertotto, E. V. **Hamblin-Dallós contact lenses.** Anales Argentinos de Oft., 1940, v. 1, July-Aug.-Sept., p. 331.

After a brief description of technique, the author expresses the hope that this procedure will become simplified to the point where every ophthalmologist will be as expert in prescribing a contact lens as dentists are in ordering dental protheses.

W. H. Crisp.

Engel, Sam. **A rotary cross-cylinder.** Amer. Jour. Ophth., 1941, v. 24, April, p. 439.

Ferrara, Aristide. **The visual threshold for blue in youth, old age, and aphakia.** Ann. di Ottal., 1940, v. 68, Feb., pp. 147-154.

This study was made by means of a new apparatus, of which a photograph and a diagram are given. Blue light in gradually increasing amount was projected upon a screen simultaneously illuminated with a constant amount of white light, and the subject, who had been kept thirty minutes in the dark, was instructed to report as soon as he perceived any blue. The intensity of the blue was controlled by varying the angle of inclination of two Nicol prisms. One group of twenty persons 18 to 38 years old, a second group of twenty persons 50 to 69 years old, and a third group of ten aphakic persons were examined. The tabulated results show that the visual threshold for blue is notably higher in the aged than in the young, and in aphakia is even lower than in young normal subjects. From this it is deduced that the absorption of blue by the crystalline lens increases with age, but that even in young persons the lens absorbs a considerable part of the blue.

Harry K. Messenger.

Hartinger, H., and Schubert F. **The modification of vision by colored protective lenses.** Klin. M. f. Augenh., 1940, v. 105, Sept., p. 337.

The authors studied the effects on vision of two protective colored lenses, namely, "umbral" and "neophan." The visual acuity was measured in a dark room 18 meters long, the subject approaching the test object (a Landolt ring) until he could see it. Each measurement was recorded only after five consistent readings. The Landolt rings were displayed in each of the 24 colors of Ostwald's standardized color series and each ring was displayed successively on six different colored backgrounds. Each subject's visual acuity was thus measured for 144 pairs of colors. Of five subjects, three had normal color vision. One was protanopic and one deuteranopic. For most of the pairs of colors, the two lenses had approximately equal effects. For some of the color pairs, however, visual acuity was greater with the umbral glass, and for a smaller number of pairs with the neophan. On the average, umbral was superior for all subjects with normal color vision and for the protanope, while neophan glass was more advantageous for the subject with green deficiency.

F. Herbert Haessler.

Holm, E., and Lodberg, C. N. **A family with total color blindness.** Acta Ophth., 1940, v. 18, pts. 3-4, p. 224.

The authors review the literature and present a detailed report of 23 cases collected on the small island of Fuur from 1,600 inhabitants who had little contact with the outside world and therefore frequently contracted intermarriages. Of the 23 cases, 19 were traced in one family comprising 300 individuals, and the other four in a family of 59 individuals. Eighteen of the 23 cases were available for examination; they were totally color blind with visual acuity reduced to 6/60 or less. The unusual feature of this group was that nine of the 23 were women and 14 men. (See editorial, Amer. Jour. Ophth., 1941, v. 24, p. 580.)

Ray K. Daily.

Hornbogen, D. P. **Transient myopia during sulfanilamide therapy.** Amer. Jour. Ophth., 1941, v. 24, March, pp. 323-324.

Laval, Joseph. **The relationship between myopia and avitaminosis.** Amer. Jour. Ophth., 1941, v. 24, April, pp. 408-412.

Luckiesh, M., and Moss, F. K. **Functions of relative accommodation.** Amer. Jour. Ophth., 1941, v. 24, April, pp. 423-428.

Ludvigh, Elek. **Extrafoveal visual acuity as measured with Snellen test letters.** Amer. Jour. Ophth., 1941, v. 24, March, pp. 303-310.

Márquez, M. **The most exact method of diagnosis in low astigmatism by use of bicylindrical combinations.** Ophthalmologia Ibero-Amer., 1940, v. 2, no. 3, p. 165.

A restatement of the author's well known opinions on this subject. (See Amer. Jour., 1930, v. 13, p. 907, and 1931, v. 14, p. 160.)

Martin, H. G. **Illumination standardization of the Snellen chart.** Amer. Jour. Ophth., 1941, v. 24, March, pp. 287-291.

Mihályhegyi, Géza. **Improvement of vision and changes produced in the refraction by means of contact glasses.** Ophthalmologica, 1940, v. 100, Oct., p. 193.

The author reports his experience with contact glasses made for 11 pa-

tients with keratoconus and quotes opinions recorded in the literature. Even slight pressure on the lids caused transient improvement in the visual acuity. Wearing a contact glass for an hour or two also improved the vision. Constant wearing not only improved the vision but caused a change in the refraction. With one exception, all of the author's keratoconus patients became hyperopic. Contact glasses might be recommended for young myopes. Of the two important factors in the development of myopia, increased axial length and increased corneal curvature, the latter may become altered by the use of contact glasses.

F. Herbert Haessler.

Missiroli, G. **Transitory myopia after ingestion of sulfamides, and its pathogenetic interpretation.** Boll. d'Ocul., 1940, v. 18, Jan., pp. 50-66. (See Section 2, Therapeutics and operations.)

Moers-Messmer, Harold. **Thoughts of a myope about the question of myopia.** Klin. M. f. Augenh., 1940, v. 105, Nov., pp. 584-593.

The author mentions the different theories concerning the cause of myopia, namely heredity and close work and their correlation. He agrees with Steiger that myopia is usually associated with high intelligence. The development of the brain may cause an increase in the length of the eyeball.

Gertrude S. Hausmann.

Moncreiff, W. F., and Scheribel, K. J. **Clinical studies concerning the alleged synergistic role of benzedrine and paredrine in homatropine cyclopegia.** Amer. Jour. Ophth., 1941, v. 24, March, pp. 282-287.

Nowak, E. **My experiences in America and the question of myopia.** Klin. M. f. Augenh., 1940, v. 105, Nov., pp. 575-583.

The author practiced ophthalmology for 17 years in Iowa. He compares the American patient with the European and finds that the average person in America is more sensitive to small refractive errors. He notes a prevalence of hypermetropia and astigmatism in American as against preponderance of myopes in the European practice. He divided his own American patients into groups and found that members of the first generation, born in Europe, showed just as many myopes as the European average, while the second and third generations were mostly hyperopic and astigmatic. He examined a large series of schoolchildren and found the same situation. The schoolchildren in the United States live in better sanitary environments, but with their voluntary reading at home they do just as much close work as the more studious European child. The author thinks that his experiences militate against Steiger's theory of myopia.

Gertrude S. Hausmann.

Rössler, Fritz. **The chromatic near-test.** Graefe's Arch., 1939, v. 141, pts. 2 and 3, pp. 305-325.

If non-accommodating eyes are corrected in front of the cobalt lamp to a certain color-picture, there is a correction-difference corresponding to the illumination-disc distance. Also, in eyes which are able to accommodate there is a correction difference, special for each eye. The smallest changes in accommodation can be perceived by the method of color dispersion. In monocular examination of young eyes, the chromatic accommodation for a certain distance does not correspond with the accommodation of the eyes in white light, because only a part of the possible

accommodation is uncovered by the cobalt lamp. This part depends upon the state of the central nervous system and upon the condition of the end organ, decreasing up to the 65th year of life. Astigmatism can change with accommodation with reference to size (up to 32 percent) and axis (18°). Eyes having the same amount of astigmatism for distance and for near may be given the full astigmatic correction; eyes which change in amount of astigmatism for far and near should receive a minimal cylindrical correction.

Charles A. Perera.

4

OCULAR MOVEMENTS

Dammskaja, H. M. **Bilateral retrobulbar neuritis and paresis of the right superior rectus caused by dental infection.** Viestnik Opht., 1940, v. 17, pts. 1-2, p. 84. (See Section 11, Optic nerve and toxic amblyopias.)

Dobson, Margaret. **Convergence.** Brit. Jour. Ophth., 1941, v. 25, Feb., pp. 66-71.

Convergence is summarized under the divisions of tonic, accommodational, and fusional (Maddox). Each of the three types is discussed. Four useful tests are reviewed. The author belives the convergence test to be the most accurate for examination of any convergence imbalance; and the prism stereoscope test to be very reliable for estimating convergence stability and the reading distance. A discussion of ductions and treatment concludes the article. (Figures.) D. F. Harbridge.

Ohm, J. **Nystagmus.** Graefe's Arch., 1939, v. 141, pts. 2 and 3, pp. 250-265.

Miners' nystagmus is a disease conditioned by different factors. One is the strain caused by long-continued gaze upward and vertically. Experiments show that constant upward movement of the eyes causes nystagmus, while downward gaze seldom has this effect. Nystagmus is at first brought about only in extreme elevation of the eyes, but later in the course of the disease it is elicited by slight upward movement of the eyes. In the severe cases the entire field of vision is affected. The energy of the nystagmus is expressed by the formula: energy = frequency × amplitude. All factors which decrease the frequency and increase the amplitude favor the appearance of nystagmus. In patients with nystagmus, elevation of the eyes has the same effect as darkening the room, producing nystagmus. Some authors believe that this is not only due to a "myopathy" of the elevator muscles, but also to overstrain of the oculomotor nuclei. For vertical movements of the eyes, these nuclei receive impulses from the voluntary area of the frontal lobe. The impulses pass through an intermediate supranuclear station, the "vertical center." Under normal conditions, the impulses of innervation for elevation and depression of the eyes are equal. In the case of miners, this equilibrium is disturbed. Charles A. Perera.

Redslob and Keller. **Ocular paralysis after spinal anesthesia.** Bull. Soc. d'Opht. de Paris, 1939, April, p. 294.

About ten days after spinal anesthesia the patient first noticed diplopia, found to be due to paresis of the left external rectus. After persisting several weeks the trouble disappeared completely. Several theories as to the pathogenesis of ocular paralyses following spinal anesthesia are discussed, the authors favoring the theory of a toxic action of the injected drugs upon the meninges and then by continuity

upon the oculomotor nerves or centers. Such a theory has the advantage of explaining the delay which characterizes the appearance of the ocular paralyses. One must bear in mind that the ocular paralysis may be symptomatic of some nervous disorder which has no connection with the spinal injection, and when it occurs the integrity of the nervous system should be determined. (10 references.)

Jerome B. Thomas.

Weckert, F. **Contribution to the problem of strabismus.** Graefe's Arch., 1939, v. 141, pts. 2 and 3, pp. 296-299.

After a short discussion of the phylogenetic development of vision, the author deals with fusion. Strabismus is due to a lack of fusion in the calcarine area, resulting in a relative cortical blindness to the images. If an eye starts squinting, the cerebral retina acquires a new functional connection (anomalous correspondence). The writer concludes that children should be treated at an early age with exercise of the amblyopic eye. He believes that strabismus can be treated without operation, and that sight can be regained in the amblyopic eye and binocular vision obtained.

Charles A. Perera.

5

CONJUNCTIVA

Chechik-Kunina, E. A. **Seasonal effect on scrofulous keratoconjunctivitis.** Viestnik Opht., 1940, v. 17, pts. 1-2, p. 37. (See Section 6, Cornea and sclera.)

Dejean, C., and Roux, J. **Treatment of trachoma by certain sulfamides in subconjunctival injections.** Bull. Soc. d'Opht. de Paris, 1939, April, p. 202.

The authors report 15 cases of trachoma treated with subconjunctival injections of "soluseptazine." The trachoma was of the granular form in all cases but of varying degrees of severity. Twelve of the patients were markedly improved, two moderately, and the result in one patient was doubtful. In no case was there aggravation of the condition. The authors conclude that this treatment is especially effective in children and in trachoma with soft lymphoid granulations, and that acute attacks yield rapidly.

Jerome B. Thomas.

Elles, N. B. **Rhinosporidiosis seeberi infection in the eye.** Trans. Amer. Ophth. Soc., 1940, v. 38, p. 369.

A review of the literature on Rhinosporidiosis seeberi, a disease caused by a rare fungus. The life history of the organism, its geographic distribution, clinical features of the disease in the eye and elsewhere, and the method of treatment are discussed. One new case is reported. David O. Harrington.

Jasserson, F., and Morard, G. **The chemotherapy of trachoma by para-amino-phenyl-solfamide (1162 F).** Bull. Soc. d'Opht. de Paris, 1939, April, p. 212.

The authors present brief reports of 21 cases of trachoma treated with sulfamide (1162 F) by mouth. The results confirm the earlier favorable reports of the authors who conclude that the treatment of trachoma by this method has given them the most rapid and constant results.

Jerome B. Thomas.

Kiparisov, H. M. **Treatment of trachomatous pannus with transplant of preserved mucous membrane from the lip.** Viestnik Opht., 1940, v. 17, pt. 3, p. 227.

In the belief that tissue transplants preserved for a time on ice have a better therapeutic effect than fresh tissue, the author excised mucous membrane from the patient's lip and, after keeping the tissue on ice for five days, implanted it above the limbus of the cornea. The results were better than those obtained with the regular Denig transplantation. Ray K. Daily.

Macnie, J. P. **Ocular lymphogranuloma venereum.** Trans. Amer. Ophth. Soc., 1940, v. 38, p. 482.

Lymphogranuloma venereum is a widespread venereal disease caused by a virus and transferable to certain animals. The Frei skin test is a reliable indicator of the condition. Nine cases of the oculoglandular syndrome of Parinaud are reported in patients infected with the virus of the disease. It may be the cause of other ocular diseases and particularly of inflammation of the uveal tract. David O. Harrington.

Nagy, Ferenc. **Trachoma and the Weil-Félix reaction.** Klin. M. f. Augenh., 1940, v. 105, Sept., p. 261. (See Amer. Jour. Ophth., 1940, v. 23, Oct., p. 1187.)

Oishi, S. **Inclusion-body conjunctivitis and trachoma with special reference to the cytology of smears.** Klin. M. f. Augenh., 1940, v. 105, Sept., p. 263.

The author found Prowazek-type inclusion bodies as well as Lindner's initial bodies in 87 of 850 cases of true and suspected trachoma, and also in 11 of 17 cases of gonococcus-negative blennorrhea neonatorum. The finding of these bodies in a smear is not pathognomonic of trachoma but only diagnostic of an inclusion-body type of conjunctival inflammation. Clinically, inclusion-body conjunctivitis may be papillary or follicular in type.

F. Herbert Haessler.

Raski, K. **The Weil-Félix serum reaction for trachoma.** Acta Ophth., 1940, v. 18, pts. 3-4, p. 321.

A review of the literature and a report of the Weil-Félix reaction in 111 cases of trachoma and 96 control cases. Finland was a particularly suitable place to determine the validity of this test, because spotted-typhus fever is unknown in that country. The findings show that the test is not specific for trachoma. Ray K. Daily.

Redslob, E., Marx, P., Dieffenbach, P., and Milaras, T. **Experimental chemotherapy of gonococcic and pneumococcic affections of the visual apparatus.** Bull. Soc. d'Opht. de Paris, 1939, April, p. 326.

The authors report three cases of gonococcic conjunctivitis and nine cases of dacryocystitis (all but one pneumococcic) treated with the organic derivatives of sulphur, rodilone and dagenan. In the cases of gonococcic conjunctivitis the dagenan gave prompt and permanent cure, whereas the equally prompt and favorable results of the rodilone were transitory. All nine cases of dacryocystitis were treated with dagenan, with complete success in three cases, partial success in two, and failure in two. The authors conclude that effective chemotherapy gives very prompt results. In favorable cases the secretion is greatly diminished, if not entirely stopped, within 24 hours after the beginning of treatment. On the other hand, if the medication is not promptly effective, continuation gives no better results. Jerome B. Thomas.

6
CORNEA AND SCLERA

Andresen, E. E. **Ultraviolet radiation of diseases of the lid border and cornea.** Viestnik Opht., 1941, v. 17, pt. 3, p. 293.

Local radiation with the Birch-Hirschfield lamp and technique justified the conclusion that this form of therapy has some value as an adjuvant to the usual therapy. It was most useful in superficial marginal and herpetic keratitis. The claim of its efficacy in blepharitis was not confirmed by the author's experience.

Ray K. Daily.

Dvorzetz, G. A. **Two cases of deep pustuliform keratitis of nonluetic origin.** Viestnik Opht., 1940, v. 19, pt. 3, p. 305.

Two brief clinical histories of this rare disease. A woman 32 years of age with bilateral involvement had developed iritis followed by keratitis; the etiology was tuberculosis, and treatment was ineffective. In the second case, a soldier 22 years old, symptomatic treatment and mercury rubs gave an excellent result. Ray K. Daily.

Lugossy, Gyula. **Paratrachoma.** Graefe's Arch., 1939, v. 141, pts. 2 and 3, pp. 234-249.

Lindner describes paratrachoma as a conjunctival disease due to infection from the genital tract. The causative agent is a virus which produces inclusion bodies. Lindner found within the inclusion bodies "initial bodies" which in a later stage form the "elementary" bodies, and he also proved the existence of free "initial bodies." In contradistinction to gonorrhea and trachoma Lindner was able to transmit inclusion blennorrhea to a monkey. The Credé prophylaxis does not prevent inclusion blennorrhea of the newborn. After an incubation period of seven to 14 days, the eyelids begin to swell, and there is purulent discharge from the conjunctiva. The acute stage lasts about seven days, and is followed by chronic papillary infiltration of the conjunctiva. The disease does not cause pannus formation, and generally heals without scars. It lasts for a few weeks or several months, and treatment has been only symptomatic. Immunity is not produced. Lindner believes that trachoma started as a venereal disease. The differential diagnosis between trachoma and paratrachoma includes the following: (1) In paratrachoma, the pathologic changes of the conjunctiva soon improve, and the conjunctiva of the lower lid is more affected. (2) In paratrachoma there is no thickening of the upper tarsus. (3) The cornea is not affected in paratrachoma. (4) The course of paratrachoma is benign. (5) Paratrachoma is always connected with venereal disease from which inclusion bodies can be demonstrated in the genital tract. Charles A. Perera.

Nausch, Bernhard. **Investigations of the mechanical properties of the pig's cornea.** Graefe's Arch., 1939, v. 141, pts. 2 and 3, pp. 214-233.

These experiments were conducted with corneas removed soon after the death of the animals, and placed so as to cover an opening in a metal ball. Pressure was exerted on the cornea. The changes were recorded by means of reflecting light upon a rotating drum. Experiments were performed by exerting pressure on the center of the cornea, by pressure near the limbus, and by increasing pressure on the center of the cornea. The properties of extensibility, elasticity, hardness, and

firmness were thus investigated. The author states the following conclusions: (1) In exerting increasing pressure on the center of the cornea, extensibility and elasticity decrease. (2) The extensibility decreases more when pressure is exerted for a longer period of time, while elasticity decreases more with pressure exerted for a shorter period of time. (3) In exerting pressure at rhythmic intervals, extensibility is decreased more than elasticity. (4) With increasing pressure, the elasticity decreases at an equal rate, while the extensibility decreases at an increasing rate. (5) In rhythmic stimulation with increasing pressure, the extensibility decreases more than the elasticity. (6) In exerting additional kinetic energy, the extensibility decreases less than without this addition. (7) The areas near the limbus are of lesser extensibility. (8) The cornea has a great resistance to rupture due to its great firmness. (9) The hardness is of minor importance. Charles A. Perera.

Reichling, Walther. **A hitherto undescribed degenerative corneal change.** Klin. M. f. Augenh., 1940, v. 105, Sept., p. 324.

The eyes of two children, both girls born of incestuous union between a degenerate father and his daughter in a family exhibiting other stigmata of degeneration, are described because of a peculiar corneal lesion. The lesion was bilateral and consisted of a concentric ring of dense superficial irregular slightly raised opacities which were in the most anterior stratum of the cornea. They were raised above the normal surface of the cornea and the larger ones projected most. The cornea as a whole was normal in thickness, but the entire substance was stippled with fine yellowish punctate opacities which extended to the utmost periphery. The lesion must be classified as an hereditary dystrophy but does not resemble any one of the three types established by Bückler in his classification. F. Herbert Haessler.

Rubbrecht, R. **Survey of the pathology and general therapy of diseases of the cornea.** Bull. Soc. Belge d'Opht., 1940, April (supplement), pp. 1-115.

This monograph is richly illustrated by 76 figures, 71 of which are photomicrographs of corneal sections chosen mainly to demonstrate the fundamental lesions of the anterior segment of the cornea. The paper is divided into seven sections: corneal infiltration, ulcer, repair, relapses, special lesions, therapy, and technique. Concerning the tendency of many corneal affections to recur after a considerable period of freedom from symptoms, the author states that this is due in a general sense to defective reconstitution of the epithelium, especially the superficial layers, which may be poorly nourished and easily eroded. Small areas of necrosed tissue lying underneath the epithelium may be the primary cause of its defective growth. One must avoid methods of treatment which may produce necrosis of the corneal tissue (and consequent dense scars). Such methods include galvanocautery and thermocautery, diathermy coagulation, X rays and caustic chemicals. The author has practised his method in more than three hundred cases of a variety of corneal lesions, with results notably superior to those obtained by the usual methods of treatment. Even after the most extensive excisions the corneal tissue regenerates itself completely and the normal curvature is reestablished. The time required is from five to six months. The report ends with a de-

tailed description of the technique of the operation and a discussion of the choice of a temporary or permanent conjunctival flap.

Jerome B. Thomas.

Szinegh, Béla. **The value of chemotherapy in the treatment of ulcus serpens of the cornea.** Graefe's Arch., 1939, v. 141, pts. 2 and 3, pp. 300-304.

Even with the usual therapy (20-percent zinc sulphate locally and foreign-protein injections for systemic effect), healing in this disease is rare without partial or complete loss of vision. Patients treated with sulfapyridine (0.5 gm. tablets three times a day for five days) showed much better end-results than those treated without this agent. Blindness never occurred in cases treated with sulfapyridine.

Charles A. Perera.

Telesheva, A. I. **The effect of convocaine on the corneal sensitivity to Frey's hair.** Viestnik Opht., 1940, v. 17, pt. 3, p. 299.

A study of the pharmacologic properties of this substitute for cocaine. The conclusion is that it is a satisfactory substitute. Ray K. Daily.

Tita, Carlo. **Primary calcareous lamellar dystrophy of cornea.** Boll. d'Ocul., 1940, v. 18, Jan., pp. 19-58.

Seven patients, whose ages ranged from 22 to 67 years, suddenly developed opacities of the cornea. These were neither preceded nor accompanied by inflammatory symptoms, nor were they provoked by trauma. They were located in Bowman's membrane or in the superficial layers of the corneal stroma, and appeared to be formed of different lamellae apparently composed of granules of calcium salts. The histologic and histochemical aspects of the spots are described and their etiopathogenesis discussed. (Bibliography, 12 figures.) M. Lombardo.

Todoroff, D. A. **Corneal scars and myopia.** Klin. M. f. Augenh., 1940, v. 105, Nov., pp. 561-575.

Myopia was present in three fourths of the cases with corneal scars. The inflammations or injuries which produced the corneal scars also caused spasm or paresis of the ciliary muscle with subsequent atrophy or contracture. The younger the patient the higher the degree of myopia found. If the injury was accompanied by a blow hyperopia resulted.

Gertrude S. Hausmann.

Vail, Derrick. **Equatorial scleral staphyloma and retinal detachment cured by excision.** Amer. Jour. Ophth., 1941, v. 24, April, pp. 403-406.

Valerio, Mario. **Intracorneal cavity in a corneal transplant.** Boll. d'Ocul., 1940, v. 18, Jan., pp. 3-18.

In a girl of 21 years corneal transplantations had been performed on both eyes. Slitlamp examination of the right transplant showed a cavity limited anteriorly by transparent corneal tissue and posteriorly by Descemet's membrane. The cavity appeared to communicate with the anterior chamber by an opening in the membrane. The writer thinks it probable that during the surgical procedure a lesion of Descemet's membrane occurred through which the aqueous made its way into the stroma of the transplant. (Bibliography, 3 figures.) M. Lombardo.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Hodes, R. **The efferent pathway for reflex pupillomotor activity.** Amer.

Jour. Physiology, 1940, v. 131, Nov. 1, p. 144.

From experiments on cats, Hodes concludes that reflex pupillary motor effects are mediated solely by the third nerve. He also concludes that in the cat no significant part of the pupillary dilatation of reflex origin is played by the sympathetic nervous mechanism.

Theodore M. Shapira.

Magitot and Dubois-Poulsen. **A case of Harada's syndrome. Severe uveitis with bilateral detachments and encephalitis.** Bull. Soc. d'Opht. de Paris, 1939, April, p. 223.

This syndrome, caused by an unknown virus, was first described by Harada, but is not confined to the Far East. It has been observed in Europe and America and is probably more common than the publications would lead one to think. The essential signs consist of a bilateral uveitis complicated rapidly by retinochoroidal detachments. Encephalitic phenomena, delirium, and vomiting may occur, as may also falling of the hair and leucoderma of the shoulders and head. The case reported by the authors is of a woman 28 years old who demonstrated eye and brain but no dermal symptoms. The etiologic virus is neurotropic and is related to that of herpes. In the case mentioned by the authors, choroidal detachment occurred between the fourth and seventh weeks. This later disappeared spontaneously and was replaced by a diffuse pigmentation of the eyeground. Jerome B. Thomas.

Thordarson, U. **Pigmented choroidal vessels. "Siegrist."** Acta Ophth., 1940, v. 40, pts. 3-4, p. 383.

The syndrome consists of albuminuria, general hypertension, and granular pigment stripes running radially towards the periphery in the fundus. The author reports seven cases of this unusual condition bringing to 22 the total number of reported cases. In all these cases the fundus appearances were similar, with but little individual variation. The average age of the 15 women and seven men was sixty years. (Illustrations.) Ray K. Daily.

8

GLAUCOMA AND OCULAR TENSION

Goldenburg, M. **Splenic extract in glaucoma.** Illinois Med. Jour., 1940, v. 78, Dec., p. 495.

The author states that splenic extract is not a cure for glaucoma, but that its greatest value is as a synergist to pilocarpine and eserine especially in the noncongestive type.

Theodore M. Shapira.

Werner, Sigurd. **Atropine in glaucoma.** Acta Ophth., 1940, v. 18, pts. 3-4, p. 295.

At 46 years of age, a patient had bilateral iridencleisis performed for glaucoma. Two years later bilateral iridotasis was done. Subsequently the left eye became blind, but the right eye held its vision and field. A degenerative process at the limbus produced a large staphylomatous cicatrix, with the iris drawn up into it. At the age of seventy years, this drawing up of the iris reduced the patient's visual acuity to counting fingers at 2 meters in strong light. With the pupil dilated vision was 5/20. Werner prescribed a solution of atropine to dilate the pupil, and with the tension checked periodically, the patient used it for seven years, up to the time of his death. Visual acuity remained 5/20 and the field normal. (Illustrations.) Ray K. Daily.

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CRYSTALLINE LENS

Bietti, Giambattista. **A purely tetanic nutritional cataract.** Klin. M. f. Augenh, 1940, v. 105, Sept., p. 299.

By means of diet the author has produced, with a high degree of constancy, cataracts which he believes to be purely tetanic and not rachitic. This accomplishment is unprecedented. The cataract is an accompaniment of a protracted latent tetany produced by a diet which is poor in calcium. The calcium deficiency must be absolute (less than 0.04 percent), and also relative to phosphorus (the ratio must not be greater than 1 to 4). There must also be a deficiency in calcium-fixing substances (vitamin D).

F. Herbert Haessler.

Bücklers, M. **Multiple lamellar cataract with spherules.** Klin. M. f. Augenh., 1940, v. 105, Sept., p. 312.

In a six-year-old girl, lamellar cataracts were unusual in that there was reduplication of the curved planes of opacification as well as four spherules 0.5 mm. in diameter with opalescent surface. Such pearls have been described before and have been shown to consist of calcium phosphate. The reduplication is very rare. Lamellar cataracts with such smooth and completely closed surfaces are seen in the frequently hereditary form known as cataracta pulverulenta. In the lenses observed by the author, the punctate opacities were even finer and more closely packed. Between the shells the lens substance was hardly disturbed. One must assume intra-uterine as well as extra-uterine development.

F. Herbert Haessler.

Duverger. **My method of cataract operation.** Bull. Soc. d'Opht. de Paris, 1939, April, p. 246.

After years of operating for cataract, first with Graefe's knife and iridectomy; later with keratome unaccompanied by iridectomy or conjunctival flap, the author finally arrived at the technique which he has practised with success for several years: simple extraction with keratome incision, conjunctival flap, and sutures. The details of the operation are described.

Jerome B. Thomas.

Gandolfi, C. **The behavior of the zonule in intracapsular cataract extraction.** Ann. di Ottal., 1940, v. 68, Feb., pp. 136-146.

The widely divergent views regarding the origin, structure, and anatomic relations of the zonule are briefly set forth, as are also the studies that have been made to determine in what part of their course the zonular fibers give way in intracapsular cataract extraction. The author examined with the microscope thirty lenses immediately after forceps extraction. No fibrils at all were found attached to 28 of these. On the equator of one were three tufts of filaments 1 by 1.5 mm. long, and the equator of another presented two long filaments. One patient, whose lens was removed in capsule and was found to be completely free from zonular fibrils, died of a heart attack three days after operation. The postoperative course had been entirely normal. The eye was examined histologically and showed filaments, evidently zonular, arising from the ciliary body. These could be followed to the back of the iris, where they were continuous with a fine membrane. The author's conclusion is that in forceps extraction the rupture of the

zonular fibers occurs normally at the point of their insertion in the equator of the lens, so that the ciliary body is little if at all traumatized. He thinks that the zonular fibers may remain in place and thus help to keep back the vitreous. Harry K. Messenger.

Jaèger, Ernst. **Experience with intracapsular extraction of cataract.** Klin. M. f. Augenh., 1940, v. 105, Sept., p. 316.

The author, who is in private practice and not associated with a large clinic, compares three hundred intracapsular extractions he has done with three hundred extracapsular operations which preceded them. In favor of intracapsular extraction is the good visual acuity and the infrequency of discission; against the procedure is the greater number of vitreous losses during operation and of iris prolapses after. The visual results alone make the strictly intracapsular extraction seem superior, but considering the complications at operation, particularly the number of capsules that tear during extraction, Jaeger believes that the two operations are approximately of equal value. F. Herbert Haessler.

Jeandelize, P., and Bardelli, P. **Experimental treatment of senile cataract with ascorbic acid.** Bull. Soc. d'Opht. de Paris, 1939, April, p. 287.

Jeandelize and Bardelli found that subjects with completely opaque senile cataract almost constantly presented a high degree of hypovitaminosis C (often only or less than 0.7 mg. per 100 c.c.). They conducted a systematic research on the effects of vitamins on all subjects with lens opacities, at the same time making a study of the urinary elimination of vitamin C. The visual acuity was taken with the aid of the stenopeic disc. Vitamin C in the form of laroscorbine was administered by mouth, by intravenous injection, and in a few cases by subconjunctival injection. Observations on 16 cases are illustrated by a table which indicates the improvement in visual acuity obtained after from one to two months of treatment. Improvement occurred in 13 cases in which the initial visual acuity was lower than 4/10. In three cases the disappearance of the opacities could be observed clinically and in several others there was a distinctly favorable change. The authors conclude that avitaminosis C is a contributing factor in senile cataract, but not the sole cause. They regard their therapeutic experiment as encouraging and believe that it indicates a path for further research.

Jerome B. Thomas.

Salit, P. W. **Sex incidence of cataract with special reference to its exogenous causes.** Acta Ophth., 1940, v. 18, pts. 3-4, p. 309.

A discussion of the various sociologic factors, especially weather conditions, which may affect cataract development. Salit believes that droughts are an important factor in the etiology of cataract. He interprets the coincidence between cataract frequency and summer droughts as indicating that radiant energy, heat, winds, and atmospheric humidity play an important part in the production of cataract.

Ray K. Daily.

NEWS ITEMS

News items should reach the editor by the twelfth of the month

Deaths

Dr. John Calvin Dye, Fayetteville, North Carolina, died March 13, 1941, aged 56 years.

Dr. George Simeon Brock, London, Kentucky, died March 6, 1941, aged 67 years.

Dr. Herbert Wright Wootton, Old Lyme, Connecticut, died February 28, 1941, aged 73 years.

Dr. Ollie P. Clark, Winchester, Kentucky, died February 23, 1941, aged 66 years.

Dr. William M. O'Brien, Greencastle, Indiana, died February 15, 1941, aged 71 years.

Dr. Edmund L. Warren, Saint Paul, Minnesota, died February 19, 1941, aged 56 years.

Dr. Fred E. Earel, Santa Ana, California, died February 11, 1941, aged 49 years.

Dr. Irving Medbury Addleman, Wausau, Wisconsin, died February 25, 1941, aged 71 years.

Dr. John Russell Fridge, Baton Rouge, Louisiana, died February 18, 1941, aged 78 years.

Dr. Frank William Sorell, San Antonio, Texas, died January 25, 1941, aged 59 years.

Dr. Carl Aschenbrenner, Pella, Iowa, died February 26, 1941, aged 75 years.

Dr. Charles Edwin Benham, Tarkio, Missouri, died February 20, 1941, aged 75 years.

Dr. Wesley D. Hicks, San Antonio, Texas, died January 18, 1941, aged 66 years.

Dr. Harmon Talley Rhoads, Sr., Everett, Washington, died February 6, 1941, aged 61 years.

Dr. Crittenden Joyes, Fort Worth, Texas, died March 23, 1941, aged 71 years.

Dr. Hiram B. Russell, Sheffield, Pennsylvania, died February 19, 1941, aged 73 years.

Dr. Sidney Fitzhugh Mioton, New Orleans, Louisiana, died February 9, 1941, aged 66 years.

Dr. George F. Woodruff, Joliet, Illinois, died February 16, 1941, aged 75 years.

Miscellaneous

The American Orthoptic Council's oral and practical examinations for orthoptic technicians will be held October 17, 1941, in Chicago. The written examinations will be held locally throughout the country on September 17th. Application for permission to take the examinations, properly endorsed by a sponsor, must be received before September 1st. These applications should be sent either to the American Orthoptic Council, 23 East 79th Street, New York, New York, or to Dr. E. B. Dunphy, 243 Charles Street, Boston, Massachusetts.

According to information received from Brazil, the Fourth Brazilian Congress of Ophthalmology will be held in Rio de Janeiro at the end of June.

The executive committee elected by the Brazilian Society of Ophthalmology is as follows: president, Prof. Octavio Rego Lopes; secretary, Dr. Natalicio de Farias; and treasurer, Dr. Ruy Rolim.

The National Commission which is to direct the scientific part of the Congress includes professors from the Faculties of Medicine throughout the country: Prof. Ivo Corrêa Meyer, of the University of Porto Alegre; Prof. Linneu Silva, of the University of Minas Geraes; Prof. Moacyr E. Alvaro, of the São Paulo School of Medicine; Prof. J. J. Britto, of the University of São Paulo; Prof. Isaac Salazar, of the Faculty of Medicine of Recife; Prof. Cesario de Andrade, of the Faculty of Medicine of Bahia; Prof. Paulo Cesar Pimentel, of the Fluminense Faculty of Medicine; Prof. Deusdedith Coelho Duarte, of the Faculty of Medicine of Pará; and Prof. Leonidas Ferreira, of the Faculty of Medicine of Paraná. The presidents of the local ophthalmological societies are also members of the committee. They are: Dr. Santayana Mascarenhas of Porto Alegre; Dr. Souza Martins of São Paulo; Dr. Francisco Ferreira of Bahia; and the president of the Medical Association of the Penido Burnier Institute.

The Brazilian Congress of Ophthalmology in Rio will be held under the patronage of the President of the Republic, the Minister of Education, and the mayor of the Federal District. The directors of the Army and Naval Services and of the National Department of Public Health will be honorary members.

There is great enthusiasm amongst opthalmologists throughout the country in connection with the Congress, and already a large number of papers dealing with all subjects pertaining to ophthalmology are being prepared for presentation, including those on the chosen subjects: "The relationship between ophthalmology and legal medicine," "Constitution in opthalmology," and "Vision of school children."

Scientific contributions are expected from all the countries of the continent, and it is very probable that a large number of ophthalmologists from several foreign countries will be present.

The Ohio Association of Supervisors and Teachers of Sight-saving Classes held its annual meeting on May 3, 1941, at the Deshler-Wallick Hotel, Columbus, Ohio. The business

meeting was followed by an interesting program consisting of a talk on "Some problems and trends in sight-saving work in high school" by Miss Harriet Totman of Cleveland, Ohio; a demonstration of dictaphone and other devices by Mrs. Lucille K. Workman, Spicer Demonstration School, Akron, Ohio; a symposium on "Sight-saving classes—What do you think of them?" with the following taking part: Miss Helen Fritz, Columbus, Ohio; Mrs. James S. Carter, Columbus, Ohio; Miss Carolyn Stites, Cincinnati; Miss Thoro MacDonagh, Newark, Ohio; and Dr. Albert D. Frost, Columbus, Ohio; and an exhibition session. Officers are: Miss Kathryn E. Wright, Cincinnati, president; Miss Gladys Tittle, Dayton, Ohio, vice-president; Miss Ethel Beever, Springfield, Ohio, secretary; Mrs. Winifred Ryan, Lorain, Ohio, Northern representative; and Miss Edna Woodward, Cincinnati, Southern representative.

Under the auspices of the Medical Society of the County of Kings of Brooklyn, New York, a post-graduate course in advanced perimetry and angioscotometry was given by Dr. John N. Evans and his staff at the Long Island College of Medicine. About 70 ophthalmologists of this city and some from neighboring states attended the course, which consisted of four lectures of two hours each, on March 7, 14, 21, and 28, 1941.

The sixth semiannual post-graduate course in Neuromuscular anomalies of the eyes was held at the Children's Memorial Hospital, Chicago, by Dr. George P. Guibor, from May 18 to 23, 1941. It consisted of a series of lectures, demonstrations of cases, and examinations of patients at the clinic.

The University of Oregon Medical School in conjunction with the Oregon Academy of Ophthalmology and Oto-Laryngology held its sixth annual spring post-graduate course from March 31 to April 5, 1941, at Portland, Oregon. Guest speakers were: Dr. Frank E. Burch, St. Paul, Minnesota; Dr. H. I. Lillie, Rochester, Minnesota; and Mr. Irving Lueck of Bausch and Lomb. Following the daily round table luncheon the afternoons were spent in clinic sessions.

Societies

At the regular meeting of the Saint Louis Ophthalmic Society, held on May 2, 1941, the following scientific program was presented: "Syncope of the retina" by Dr. T. E. Sanders; Communication: Recent advances in cataract surgery, illustrated by a motion picture.

Personals

Dr. F. Carleton Thomas announces the association of Dr. Walter D. Frey, formerly of Indianapolis, in practice at 200 North Upper Street, Lexington, Kentucky.

The following members of the ophthalmological service at the Long Island College Hospital and also the Brooklyn Eye and Ear Hospital have been called to serve in the United States Army: Dr. Mortimer Lasky as Major, Dr. Morris Pincus as Captain, and Dr. Charles Hopkins at First Lieutenant.

Dr. Ralph Lloyd has been appointed consultant in ophthalmology at the Brooklyn Eye and Ear Hospital.

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